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September 22, 2016

Ms. Beverly Carver
Senior Water Permit Writer
Virginia Department of Environmental Quality
Valley Regional Office
4411 Early Road, Harrisonburg, VA 22801

DEQ VALLEY
SEP 23 2016
To: _____
Date: _____

**RE: Dominion Breomo Power Station VPDES Permit No. VA0004138:
Centralized Source Water Treatment System CER Revision**

Dear Ms. Carver:

Enclosed is a revised version of the Concept Engineering Report (CER) for the Centralized Source Water Treatment System (CSWTS) that Dominion is utilizing to treat wastewaters generated during the ash pond closure project at the Breomo Power Station. Revision 3 to the CER submitted on March 30, 2016 has been updated as follows:

1. Updated the date to September and named it Rev. 4 [cover page and headers]
2. Updated the engineering seal [cover page]
3. Added Table 4 - Summary of CSWTS Process Chemicals, and added alternative chemicals [Table of Contents and Tables section]
4. Revised Drawing 4 – Equipment and Process Lay-out (Rev. 3) to better reflect as-built conditions and to generalize the process chemical references to allow the use of alternate chemicals as needed for the treatment system optimization. [Table of Contents and Drawings section]
5. Revised Drawing 5 – Influent/Effluent Storage Plan (Rev. 3) to reflect the schematic use of influent storage tanks. [Table of Contents and Drawings section]
6. Text changes to remove “inactive” and to make other minor updates reflecting the current status of pond closures. [Section 1.0 text]
7. Modifications to the source water descriptions to keep Outfall 003 open for segregated non-contact stormwater during phased construction. [Section 2.4 last sentence removed and Section 2.5 last sentence added]
8. Changes to remove unnecessary details in the CSWTS description (e.g., pipe diameters, pump flow ratings, alarm details) and added some generalized descriptive items (e.g., transfer pumps, diffuser nozzles). [Sections 4.1, 4.2, 4.3, and 4.3.1 throughout]
9. Added a statement that the CSWTS will be constructed with parallel treatment system components to accommodate varying process flow rates. [Section 4.2 first paragraph]
10. Added the option to use oxidants as well as aeration. [Section 4.3 first paragraph]

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11. Changed the target influent pH to 7.5-10 SU depending on influent water quality. [Section 4.3 fourth paragraph]
12. Added aeration to the pH adjustment tank if necessary, and additional pH adjustment options downstream. [Section 4.3 fourth paragraph]
13. Added the option to re-purpose up to effluent storage tanks as temporary influent storage tanks. [Section 5.0 last paragraph]

Please contact Ken Roller of my staff at (804) 273-3494 or by email at kenneth.roller@dom.com should you have any questions or require additional information about this transmittal.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,



Paula A. Hamel
Director, Generation Environmental Services

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Concept Engineering Report
Source Water Treatment System

A world of
capabilities
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CONCEPT ENGINEERING REPORT

CENTRALIZED SOURCE WATER TREATMENT SYSTEM

Bremo Power Station



Dominion

Submitted To: Virginia Electric and Power Company
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Bremo Bluff, VA 23022

Submitted By: Golder Associates Inc.
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January 2016
Revised September 2016 (Rev. 4)

1520-347.300



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1.0 INTRODUCTION

This Concept Engineering Report (CER) has been prepared for the proposed Centralized Source Water Treatment System (CSWTS) at Dominion's Brema Power Station (Station), located in Fluvanna County, Virginia. The Station converted from a coal-fired power plant to a natural gas-fired power plant in 2013. Coal Combustion Residuals (CCR) from historical coal-fired operations are stored in three impoundments on-site (North Ash Pond, West Ash Pond, and East Ash Pond). Process water from these ponds and other Station activities has historically been discharged with contact stormwater to the James River pursuant to the authorization, limits, and conditions of Virginia Department of Environmental Quality (DEQ) Virginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0004138 (Permit).

Dominion is in the process of closing three CCR surface impoundments in accordance with the U.S. Environmental Protection Agency's (EPA's) final CCR rule, which is codified at 40 CFR 257, and which has also been adopted by reference into the Virginia Solid Waste Management Regulations (VSWMR) at 9VAC20-81-10 *et seq.* Closure of the West Ash Pond will be accomplished by removing the CCR, and re-purposing the eastern portion of the impoundment as the new West Treatment Pond. Closure of the North and East Ash Ponds will be accomplished by dewatering the CCR and capping it in place. In concert with closure of these three CCR impoundments, Dominion will also close the Metals Pond by dewatering and removing accumulated solids. During the closure activities, wastewater will be generated and will require treatment to ensure compliance with the limitations and conditions in the Permit, which was reissued by the State Water Control Board on January 19, 2016. Wastewater generated during the closure of the East, West, and North Ash Ponds, as well as wastewater associated with closure of the station's Metals Pond, will be directed to the CSWTS, which will be monitored at outfall 504. Dominion has prepared this CER to provide a description of the proposed CSWTS, which has been specifically designed to comply with the numeric effluent limitations in Part I.A.9 of the Permit. The CSWTS was brought on-line and operated following DEQ approval of this CER.

The conceptual engineering systems and processes presented herein reflect the planned conceptual approach for the CSWTS and may not reflect the specific details of the final design system configuration. Prior to system operation, a certification will be provided in writing that based on inspection of the project, the CSWTS construction was completed in general accordance and intent with this CER.

1.1 Site Description

The Brema Power Station is owned and operated by Virginia Electric and Power Company doing business as Dominion Virginia Power (Dominion) in Fluvanna County, Virginia, at 1038 Brema Road, just east of Route 15 (James Madison Highway) and north of the James River. The location of the Station is illustrated on the inset United States Geological Survey (USGS) topographic map on Drawing 1. A Site Plan is presented on an aerial photograph as Drawing 2. The Station property consists of wooded, open, and

developed land just north of the James River. The Station's northern, eastern, and western boundaries are bordered by primarily undeveloped parcels, and the Station is bordered to the south by a CSX rail line and the James River. Land use surrounding the Station is classified as "A-1 Agricultural," and consists of undeveloped wooded and agricultural properties within a rural residential setting.

2.0 WASTEWATER SOURCES

The Process Flow Diagram on Drawing 3 depicts the wastewater sources to the proposed CSWTS during the closure activities for the West, North, and East Ash Ponds, and the Metals Pond. These wastewater sources are described below.

2.1 Metals Pond Pumped Decant Water

Metals Pond Pumped Decant Water is surface water that has accumulated in the Metals Pond and needs to be removed as an initial step to facilitate closure. In the past, this water was periodically pumped to the West Ash Pond via internal outfall 202 for ultimate discharge to the James River via outfall 002.

Decanting shall be accomplished by pumping decant water either to the West Ash Pond (after monitoring for compliance with the Permit Part I.A.4 limits for internal outfall 202), or to the CSWTS for treatment prior to discharge via internal outfall 504. Alternatively, the Metals Pond Pumped Decant Water may be transported off-site for treatment and/or disposal at a permitted facility. If routed to the West Ash Pond, decanting will continue until the limits and conditions in Part I.A.9 are triggered pursuant to Part I.G.19, at which time the Metals Pond Pumped Decant Water will be routed to the CSWTS for treatment prior to discharge.

2.2 Metals Pond Contact Stormwater

Metals Pond Contact Stormwater is stormwater that, following removal of the decant water, has contacted the accumulated material in the Metals Pond during closure of the Metals Pond. Metals Pond Contact Stormwater will need to be removed from the Metals Pond to facilitate closure. The Metals Pond Contact Stormwater will be routed to the CSWTS for treatment prior to discharge via internal outfall 504. Alternatively, the Metals Pond Contact Stormwater may be transported off-site for treatment and/or disposal at a permitted facility.

2.3 Metals Pond Material Dewatering Water

Metals Pond Material Dewatering Water is the water that will be produced from dewatering the accumulated material in the Metals Pond to allow for its removal and off-site disposal. This waste stream will be directed to the CSWTS for treatment prior to discharge through internal outfall 504.

2.4 Impoundment Decant Water

Impoundment decant water (IDW) includes surface waters that result from the commingling of a number of wastewater types, including but not necessarily limited to: stormwater, low volume wastewater, sewage treatment plant (STP) discharges, ash dewatering water, and waters that are used to convey CCR to an impoundment through sluicing or dredging. As an initial step in the process leading to closure of the North Ash Pond, it will be necessary to remove the IDW in order to dewater the ash enough to allow for preparation of a stable surface on which to construct the closure cap. IDW from the North Ash Pond will be routed to the CSWTS for treatment and discharge through internal outfall 504.

2.5 Ash Pond Contact Stormwater

Ash Pond Contact Stormwater is stormwater that has contacted the CCR in the North, East, and West Ash Ponds, and is considered process wastewater. This waste stream will be directed to the CSWTS for treatment prior to discharge through internal outfall 504. Segregated non-contact stormwater will be discharged through existing permitted outfalls.

2.6 Ash Pond Ash Dewatering Water

Ash Pond Ash Dewatering Water is considered to be the pore water within the CCR mass in the West, North, and East Ash Ponds. This wastewater refers to the water that is produced from dewatering the CCR to stabilize the CCR and allow for its removal by mechanical dredging or excavation (West Ash Pond), or to support the closure cap system (North and East Ash Ponds). It is generated from the CCR dewatering process through mechanical means (e.g., vacuum wells, sump pumps, or other *in situ* withdrawal methods) and from cutting drainage ditches or rim ditches into the CCR mass. Ash Pond Ash Dewatering Water will be directed to the CSWTS for treatment prior to discharge through internal outfall 504.

3.0 WASTEWATER CHARACTERISTICS

To characterize the expected quality of most wastewater sources to be treated in the CSWTS, a series of sampling events was conducted between March and June 2015 by an independent consultant. During these events, samples were collected from representative locations within the source streams for various analyses as shown on the Site Plan (Drawing 2).

During each sampling event for each source water, representative samples were collected using appropriate equipment by qualified sample technicians following EPA surface water sampling protocols and industry standards for groundwater (*i.e.*, piezometer) sampling. Samples collected for dissolved analysis were laboratory-filtered with a 0.45-micron filter.

The samples were collected in laboratory-provided, pre-preserved (laboratory-filtered metals containers were preserved by the laboratory after filtering), pre-labeled sample containers and placed on ice in a cooler under chain-of-custody control pending delivery to the laboratory for analysis. Samples for analysis by

Environmental Conservation Laboratories, Inc. (ENCO) of Cary, North Carolina were shipped to ENCO via commercial overnight courier under chain-of-custody control, and samples for analysis by Air, Water and Soils Laboratories, Inc. (AWS) of Richmond, Virginia, were delivered to AWS under chain-of-custody control. Both AWS and ENCO and their subcontractor laboratories are Virginia Environmental Laboratory Accreditation Program (VELAP) accredited laboratories. The results of the laboratory analyses for those constituents subject to numeric effluent limitations in the Permit are presented in Table 1 and are summarized in Table 2.

The samples collected from PZ-1 (North Ash Pond CCR) and PZ-2 (East Ash Pond CCR) are representative of the expected ash dewatering water quality prior to any additional treatment. The sample results indicate elevated metals concentrations (total and dissolved) for certain metals, particularly in the PZ-2 samples collected from the East Ash Pond. In general, these elements are: antimony, arsenic, barium, boron, cadmium, chromium, cobalt, copper, lead, nickel, thallium, vanadium, and zinc. In addition, the ash dewatering water samples have elevated total suspended solids (TSS) concentrations in comparison to the other source waters, contributing to the elevated total metals concentrations. In general, the dissolved metals concentrations in the ash dewatering water samples (PZ-1 and PZ-2) are substantially lower than the total metals concentrations, indicating the attenuating effect of filtration on the metals concentrations, with the exceptions of boron and molybdenum.

The elevated metals concentrations are expected to be attenuated significantly with TSS controls, and thus, the CSWTS is designed to remove TSS with provisions for metals recovery using pH buffering, aeration, and other oxidative processes combined with hydraulic retention time and solids recovery (see Section 4.0 for treatability study results).

The North Pond Toe Drain sample had elevated concentrations of TSS and iron, when compared to other effluents; however, for the majority of parameters, concentrations in the North Pond Toe Drain were lower than those measured in the other sources.

To characterize the North Ash Pond IDW, a series of sampling events was conducted from late October 2015 to present. During each event, three representative water samples were obtained for analysis of the constituents subject to numeric effluent limitations in the Permit. The catwalk over the North Ash Pond was used to obtain water samples from the North Ash Pond at depths of 1 foot and 4 feet below the surface near the weir structure. These "NP Catwalk" samples are intended to represent surface water and mid-column water (*i.e.*, IDW). A third sample was collected at the inlet pipe to the North Pond Pool ("NP Pool," near the East Ash Pond). Table 3 presents the analytical results, as compared to the Permit limits. As shown, the North Ash Pond IDW samples meet the Permit limits.

4.0 TREATABILITY

To determine the effectiveness of chemical precipitation and filtration in treating the wastewater to meet the discharge limitations specified in the Permit, Golder commissioned Ground/Water Treatment & Technology, LLC (GWTT) to perform treatability studies. GWTT followed the protocol provided by Adega Chemical Company (see Appendix A – *Bench-scale Testing Guidelines for the Reduction of Sediment and Colloidal Particles*). Three treatability studies were performed, two in a laboratory and one on-site. The reports are presented in Appendix B. The results of the studies indicate that a treatment process involving aeration, hydroxide precipitation, followed by coagulation / flocculation / settling will reduce the contaminants of concern to below the discharge limits in the Permit. Note that two of the treatability studies were performed prior to reissuance of the VPDES permit and, therefore, comparisons in the tables associated with these study reports were made between treated effluent concentrations and draft permit limits. The limitations in the final permit are consistent with the draft permit limitations referenced in the treatability studies. It is also noted that the quantitation limits (QLs) used by the laboratory during the treatability studies differ somewhat from those specified in the reissued permit; however, the QLs achieved by the laboratory have no adverse bearing on the results or reliability of the treatability studies in designing the CSWTS.

The proposed CSWTS is designed based on the results of these treatability studies. The proposed CSWTS consists of a source water collection system from which the source waters may be commingled, and then conveyed to the water treatment components for treatment, effluent sampling, and discharge. Drawing 4 depicts the equipment and process lay-out of the CSWTS.

4.1 Collection System

At each pond location undergoing closure, a spill containment area (approximately 100 feet by 60 feet) will be constructed to house equipment to collect and transfer the source waters from the pond decanting/dewatering activities to the CSWTS. The equipment components of each collection and transfer system will generally include:

- One (1) 21,000-gallon, closed-top tank;
- High density polyethylene (HDPE) piping from the source pumps to the tank;
- One (1) diesel pump capable of conveying collected water to the CSWTS;
- Integral fuel tank (estimated to be 200 gallons);
- Hoses, pipes, and fittings as required within the spill containment area;
- Alarm panel and overflow protection system, and;
- Small generator, control wiring, and power cables as required.

Temporary influent storage tanks may be used as needed to accommodate periods of low-flow operations or peak contact stormwater generation to effectively manage influent source water quantities. Existing effluent tanks may be repurposed as influent storage tanks. Source water may be routed directly to the influent storage tanks or CSWTS.

4.2 Treatment System Components

The source waters from the collection systems will be conveyed for treatment to the CSWTS, which is a modular, integrated treatment system. Temporary equalization/storage capacity for the raw source water influent to the CSWTS may be utilized as necessary for effective wastewater management. The CSWTS will be located in a spill containment area (approximately 240 feet by 80 feet) and be constructed with parallel treatment system components to accommodate varying process flow rates. The CSWTS equipment will consist of the following components (some modifications to these specifications may be necessary in order to optimize treatment efficiency and/or accommodate reductions in wastewater flows as the project progresses):

- HDPE piping into the equalization/aeration tank;
- One (1) 18,000-gallon, open-top equalization/aeration tank supplied with a transfer pump(s), pressure blower, and diffuser nozzles;
- One (1) 18,000-gallon, open-top pH adjustment tank supplied with a transfer pump, pH adjustment system, and diffuser nozzles;
- Three (3) open-top, chemical mix tanks each supplied with electric mixers;
- Five (5) v-bottom clarifiers plumbed in parallel, each supplied with removable settling tube media;
- Three (3) chemical feed systems for the introduction of liquid coagulant and flocculent to each chemical mix tank;
- One (1) sludge handling system consisting of an electric sludge pump, poly cone bottom tanks, and pumps feeding a mobile filter press;
- One (1) mobile filter press to convey filter cake;
- Two (2) transfer pumps, one (1) primary and one (1) back-up;
- Two (2) duplex 23-bag filtration systems;
- Two (2) duplex 6-bag filtration systems;
- One (1) triplex 22-cartridge filtration system;
- Three (3) duplex 36-cartridge filtration system;
- One (1) mechanical process flow meter with totalizer;
- One (1) 18,000-gallon open-top effluent holding tank/pH adjustment tank supplied with a pH adjustment system and electric mixers;
- One (1) primary generator, one (1) back-up generator, one (1) manual transfer switch, and one (1) fuel holding tank;
- One (1) 480-volt (V), 3-phase main distribution panel;
- Control wiring and power cables from the generators to the main electrical distribution panel, and from the main electrical distribution panel to the individual equipment skids;
- Alarm panel and overflow protection are incorporated in several areas of the CSWTS, and;
- Hoses, pipes, and fittings as required between the treatment system components within the spill containment berm.

4.3 Treatment Process

Raw source water will be conveyed to the aeration tank. The aeration tank is an 18,000-gallon (nominal), open-top, tank. Air will be injected into the aeration tank (as needed) via an electric blower piped to air diffuser nozzles in order to oxidize the dissolved metals. If a stronger oxidant is needed, sodium hypochlorite or hydrogen peroxide may be used to oxidize dissolved metals in place of aeration. Safety Data Sheets for sodium hypochlorite and hydrogen peroxide are provided in Appendix C.

Water from the aeration tank will be pumped to the initial pH adjustment tank at a maximum system flow rate of 1,500 gpm.

The transfer pumps will be provided with a local control system with 'pump on' and 'pump off' float controls and high level alarms. The pH and aeration tanks will have high level alarms to alert the operator of an abnormal operating condition and to automatically shut off the raw water feed pump to discontinue the forward flow to the treatment system.

A pH probe will be submerged in a downstream chamber of the pH adjustment tank. The probe will be wired to a pH controller that will communicate with the hydroxide feed pumps and inject hydroxide, if necessary, to increase the pH of the incoming water to approximately 7.5 to 10.0 standard units depending on influent water quality. Electric mixers will be installed in the pH adjustment tank to ensure proper mixing of the water and hydroxide. If additional aeration is needed, air can be injected into the influent chamber of the pH adjustment tank via the existing electric blower piped to air diffuser nozzles. The pH can be further adjusted downstream of the pH adjustment tank in either the effluent piping of the pH adjustment tank or in the downstream chemical mix tanks of each train to maintain the pH range for chemical precipitation.

Water from the pH adjustment tank will be pumped to chemical mix tanks via transfer pump skids consisting of a primary pump and secondary pumps to allow for a maximum of 500 gpm of flow to each treatment train.

Water will pass through magnetic flow meters and throttling valves to monitor and control the amount of water being pumped from the pH adjustment tank to each chemical mix tank. The magnetic flow meters will also be used to pace the amount of coagulant and flocculent injected into each chemical mix tank.

Prior to entering the chemical mix tanks, water will flow through an in-line static mixer where a coagulant will be injected via a chemical metering pump. A list of coagulants that may be used (as needed) in the CSWTS is provided in Table 4. The Safety Data Sheet for each coagulant is provided in Appendix C. The coagulant is used to change the electrical charge of the fine particles and to cause a destabilization of the particles. A spare coagulant feed pump will be provided in case the primary coagulant feed pump needs to be serviced or replaced.

Water will then enter the chemical mix tanks. The chemical mix tanks are 11,000-gallon (nominal), open-top, steel tanks equipped with weirs and baffles. Flocculent will be added to the chemical mix tanks using a chemical metering pump. Flocculent is used to bring the charged particles together and to make them heavier, which will allow for better settling in the downstream clarifier. The actual flocculent used will be determined based on jar testing performed using representative water during on-site start-up. A list of alternative flocculents that may be used (as needed) in the CSWTS is provided in Table 4. The Safety Data

Sheet for each flocculent is provided in Appendix C. A spare flocculent feed pump will be provided in case the primary flocculent feed pump needs to be serviced or replaced.

The chemical mix tank will be equipped with electric mixers to further mix the coagulant into the water stream, as needed, and to ensure proper mixing of the water and flocculent. Flow pacing for the chemical feed pumps feeding the coagulant and flocculent will be achieved using the magnetic flow meter installed upstream of the chemical mix tanks. The chemical mix tanks will be elevated to allow the water to flow by gravity from the chemical mix tanks to the clarifiers to minimize the shearing of any floc particles prior to entering the clarifiers.

The chemical mix tanks will be equipped with liquid level alarms. The high level alarm will activate an indicator light on the alarm panel, and activate a strobe light to alert the operator of a high level condition in a chemical mix tank. The high-high level alarm will activate an indicator light on the alarm panel, and activate a strobe light to alert the operator of a high-high level condition in the chemical mix tanks, and also send a signal to shut down the transfer pumps pumping water from the pH adjustment tank to the chemical mix tanks.

Water will flow by gravity from the chemical mix tanks to the clarifiers. The clarifiers are equipped with a number of features that will facilitate both the settling of solids and routine maintenance of the units. Water to the clarifiers is directed to an influent chamber. A weir plate extending from the top of the unit forces the water underneath removable settling tube media. Treated water flows upward through the settling tubes while solids collect and fall to the bottom of the bulk settling clarifier. Tube settlers capture the settled fine floc that escapes the clarification zone beneath the tube settlers, and allow the larger floc to travel to the tank bottom in a more settled form. The tube settler's channel collects solids into a compact mass that allows the solids to slide down the tube channel.

Solids and/or sludge that have settled to the bottom of the clarifiers will need to be periodically removed and pumped to two sludge holding tanks plumbed in parallel. The sludge holding tanks are cone bottom poly tanks each with a nominal capacity of 2,600 gallons. Sludge should be removed from the clarifiers when solids begin passing through the clarification zone and into the effluent portion of the clarifiers. The sludge removal system for each of the clarifiers consists of an electric auger sludge pump. Sludge is removed from each chamber and pumped to the sludge holding tank where sludge can be condensed, and free water can be decanted back to the initial pH adjustment tank via a decant tank and an electric decant pump. The remaining solids in the sludge holding tank will then be pumped via a second sludge pump to a trailer-mounted filter press. Filter cake from the filter press will be dropped onto a conveyor that will direct the filter cake to a lined roll-off container. The contained filter cake will be managed as a special waste under the VSWMR, and will be characterized as required by the VSWMR and the permitted disposal facility selected to receive the waste. The filtrate generated from dewatering will gravity-feed into a filtrate holding tank and be decanted back to the initial pH adjustment tank via an electric decant pump.

The sludge holding tanks will each be equipped with a high level alarm float. The high level alarm will activate an indicator light on the alarm panel, and activate the strobe light to alert the operator of a high level condition in the sludge holding tanks, and also send a signal to shut down the electric sludge pump feeding the sludge holding tank.

Clarified water will rise above the settling tube media and flow over a final weir plate into an effluent chamber. Water in the effluent chamber of the clarifiers will flow by gravity from the clarifier to the pump suction tank. The effluent chamber of the clarifier will be equipped with liquid level alarms. The high level alarm will alert the operator of a high level condition in the clarifier to shut down the pumps pumping water from the pH adjustment tank to the chemical mix tank.

Water in the pump suction tank will be pumped through the filtration step, which consists of three sets of bag filter housings and one cartridge filtration housing, to the final pH adjustment tank containing electric mixers. The transfer pumps will process water through the duplex multi-bag filter skids as well as the cartridge filtration skid. The first two sets of bag filters will consist of two duplex 23-bag filter housings plumbed in parallel. The inlet and outlet of the bag filter skids will be equipped with manifolds complete with isolation valves. Each of the filter housings will contain 23 #2 filter bags designed to remove TSS, sediment, and filterable metals from the process water prior to discharge. The micron rating of the filter bags will be 5-25 microns depending on water quality and discharge requirements. The inlet and outlet of each of the bag filter housings will also be equipped with pressure gauges to monitor the differential pressure across the filter housing. The bag filters should be changed once the differential pressure across the housing reaches 15 to 20 pounds per square inch (psi). The bag filter housings will be plumbed in parallel such that the bags in one filter housing can be changed while the remaining filter housing continues to process water at the desired water flow rate.

The third set of bag filters will consist of three duplex 6-bag filter housings plumbed in parallel. The inlet and outlet of the bag filter skid will be equipped with manifolds complete with isolation valves. Each of the filter housings will contain six #2 filter bags designed to remove TSS, sediment, and filterable metals from the process water prior to discharge. The micron rating of the filter bags will be 1-5 microns depending on water quality and discharge requirements. The inlet and outlet of each of the bag filter housings will also be equipped with pressure gauges to monitor the differential pressure across the filter housing. The bag filters should be changed once the differential pressure across the housing reaches 15 to 20 psi. The bag filter housings will be plumbed in parallel such that the bags in one filter housing can be changed while the remaining filter housing continues to process water at the maximum design water flow rate of 500 gpm per 6-bag filtration skid.

The fourth set of filters will consist of two duplex 36-cartridge filter housings and one triplex 22-cartridge filter housings plumbed in parallel. The inlet and outlet of the cartridge filter skids will be equipped with manifolds complete with isolation valves. Each of the duplex filter housings will contain thirty-six

(36) 30-inch cartridges. Each of the triplex filter housing will contain twenty-two (22) 30-inch cartridges. The cartridge filter housings are designed to remove TSS, sediment, and filterable metals from the process water prior to discharge. The micron rating of the filter cartridges will be 0.5-1 micron depending on water quality and discharge requirements. The inlet and outlet of each of the cartridge filter housings will also be equipped with pressure gauges to monitor the differential pressure across the filter housing. The cartridge filters should be changed once the differential pressure across the housing reaches 15 to 20 psi. The cartridge filter housings will be plumbed in parallel such that the cartridges in one filter housing can be changed while the remaining filter housing continues to process water at the desired water flow rate. The spent cartridge filters will be disposed of as solid waste at a permitted solid waste disposal facility.

If the bag/cartridge filters are not properly operated and maintained, the differential pressure across the filter housings can rise to the point that the pumps cannot pump water from the pump suction tank faster than water is introduced into the pump suction tank. The water level in the pump suction tank will rise and eventually activate the high level and high-high level alarm light. An adjustable differential pressure switch will be installed across the duplex bag/cartridge filter skids to alert the Operator that the filter(s) needs to be changed. The adjustable differential pressure switch will be set at approximately 15 psi. When this pressure is reached, the differential pressure switch will illuminate an indicator light on the alarm panel to alert the Operator of a high differential pressure condition across the bag/cartridge filter skids.

The final pH adjustment tank is an 18,000-gallon (nominal), open-top, tank. Two pH probes will be submerged in two chambers of the pH adjustment tank. The pH probes will be wired to a pH controller that will communicate with the feed pumps and inject acid (or hydroxide if operating the enhanced metals treatment), if necessary, to decrease (or increase) the pH of the water within the effluent permit limit of 6.0 to 9.0 standard units. Electric mixers will be installed in the final pH adjustment tank to ensure proper mixing of the water and pH adjustment chemicals.

Water in the pH adjustment tank effluent chamber will be pumped to effluent storage tanks using a transfer pump. A mechanical flow meter with a totalizer will be provided at the end of the treatment system to indicate the flow rate and to record the total gallons of water treated and discharged. Flow readings should be recorded daily in a log book.

The final pH adjustment tank will be equipped with a pH sensor with a local readout. If the pH sensor detects a pH value outside of the pre-set range, it will illuminate an indicator light on the alarm panel to alert the operator that the effluent pH is out of range. An in-line turbidity monitor will also be installed to monitor the effluent turbidity of the water in the treatment system. A list of pH adjustment chemicals that may be used (as needed) in the CSWTS is provided in Table 4.

The individual components of the CSWTS will be skid-mounted to the greatest extent possible, and will be interconnected using HDPE piping, polyvinyl chloride (PVC) piping, and suction hose. Pressure gauges,

flow meters, and sample taps will be located throughout the CSWTS to monitor system performance. Sampling of the final CSWTS effluent will be conducted in accordance with the Permit to comply with Parts I.A.9 and I.C. Storage capacity for the effluent from the CSWTS will be provided to effectively manage the wastewater, as described in Section 5.0. Effluent monitoring for compliance with Part I.A.9 limits will be performed on the effluent from the storage vessel(s). Isolation valves will be provided on the inlet and outlet of each of the major units to isolate them for maintenance.

An indicator/alarm panel will be mounted within the CSWTS area, with indicator lights for the various alarm conditions. A main disconnect will also be mounted within the CSWTS area to distribute power to the various pump control panels, and the indicator/alarm panel.

4.3.1 Enhanced Treatment (if necessary)

The treatability studies indicate that the proposed CSWTS as described above can achieve the discharge limits specified in the Permit. However, provisions for enhanced treatment are provided in this CER. As shown on the Equipment and Process Lay-out diagram (Drawing 4), an area (approximately 40 feet by 75 feet) is designated for an additional metals treatment module consisting of a chemical reducing agent addition in the aeration tank followed by pH adjustment and adsorptive media vessels in between the cartridge filters and the final pH adjustment tank. In-line process samples will be collected at a minimum frequency of once every four (4) hours from a location prior to the enhanced treatment module(s) (S1 sampling location on Drawing 4), and analytical results will be returned within one (1) hour after sample collection. If effluent from the treatment system exceeds any of the pollutant concentration triggers presented below, as determined by in-line process sampling, then the effluent will be routed through enhanced treatment:

- Arsenic – 100 ug/L
- Antimony – 640 ug/L
- Selenium – 5.0 ug/L
- Thallium – 0.47 ug/L
- Lead – 7.4 ug/L
- Copper – 6 ug/L

The enhanced treatment can likewise be turned off should in-line process sampling determine that pollutant concentrations prior to the enhanced treatment system are below the trigger limits. Dominion reserves the right to operate the enhanced treatment system at any time, even if trigger limits have not been exceeded.

A monthly report will be submitted to the DEQ, which will provide dates when enhanced treatment was turned on or off. Process samples will be grab samples and will be analyzed using methods that will achieve the Quantification Levels (QLs) specified in the VPDES permit.

Raw source water conveyed through an influent flow meter will be dosed with a chemical reducing agent prior to introduction to the aeration tank. The reducing agent will then be slowly mixed in the aeration tank by the use of mixers prior to aeration. The purpose of the chemical reducing agent will be to reduce soluble forms of dissolved metals into a more insoluble form so that the majority of metals reduction will occur in the chemical precipitation process. A list of reducing agents that may be used (as needed) in the CSWTS is provided in Table 4. The raw source water will be treated as described in the treatment process before being conveyed through the adsorptive media vessels.

From the cartridge filter skid, water can be diverted under pressure to a metals pH adjustment tank prior to being pumped through the adsorptive media trains plumbed in series. The pH adjustment tank is an 18,000-gallon (nominal), open-top, tank. pH probes will be used in the pH adjustment tank. The pH probes will be wired to a pH controller that will communicate with the acid feed pumps and inject acid, if necessary, to decrease the pH of the water to 5.0 to 6.5 standard units for pretreatment prior to the adsorptive media trains. Electric mixers will be installed in the pH adjustment tank to ensure proper mixing of the water and acid. Water in the pH adjustment tank effluent chamber will be pumped to the adsorptive vessels treatment trains using a transfer pump. A list of acids that may be used (as needed) in the CSWTS is provided in Table 4.

Each treatment train will consist of two adsorptive media vessels for the reduction of the dissolved metals concentrations. Each treatment train is designed for a flow rate of 250 gpm to allow for an empty bed contact time (EBCT) of 10 minutes adsorption per lead vessel. A total of 12 adsorptive media vessels (six trains of lead and lag vessels at a maximum flow rate of 250 gpm per vessel train) will be installed to treat for a maximum design flow rate of 1,500 gpm.

The adsorptive media vessels will each contain a mixture of crushed limestone and activated alumina, which is designed to reduce the dissolved metals prior to discharge. If breakthrough of dissolved metals occurs on the lead unit, the water will be treated through the lag unit temporarily. The spent media will be removed from the lead unit and will be replaced. The spent media will be sampled to determine RCRA waste characteristics, and will be disposed of accordingly. Periodic sampling of the effluent of adsorptive media unit #1 (S2 sampling locations on Drawing 4) will determine if dissolved metals breakthrough is occurring, and will alert the operator as to when to replace the media in the lead vessel.

The inlet and outlet of each adsorptive media vessel will be equipped with a pressure gauge to monitor the differential pressure across the media. The differential pressure across each adsorptive media vessel will be recorded in a log book on a daily basis. If the differential pressure across a particular adsorptive media vessel rises to the point that water flow is restricted (as measured by the effluent flow meter), that adsorptive media vessel will be taken off-line, and the media will be either replaced or backwashed (to the aeration tank) in an attempt to reduce the pressure in the unit due to excessive pressure drop.

5.0 EFFLUENT STORAGE TANKS

Temporary effluent storage tanks optionally will be used to provide hydraulic retention of treated effluent prior to release. Four 950,000-gallon temporary aboveground storage tanks may be erected to provide a storage capacity of up to 3,800,000 gallons. The storage tanks will be erected on top of the former closed coal yard and set on a compacted aggregate base (Drawing 5). The inside of the tanks will be lined with a geomembrane liner for water-tight containment, and the prepared area will be provided with spill containment.

The temporary storage tanks will be used in conjunction with the CSWTS. The tanks will be operated in rotation to hold approximately 12 hours of treated effluent at an operating rate of up to 1,500 gallons per minute. As identified on Drawing 5, internal outfall 504 will be located on the effluent side of the tanks. Outfall 504 will be the metered outfall compliance sampling location. Effluent discharge from the storage tanks will be up to 1,500 gallons per minute.

Process monitoring may be performed within the tanks (S3 sampling locations on Drawing 5) at various times to confirm the CSWTS is operating as designed to meet the permitted effluent limits prior to discharge. In the unlikely event that process monitoring indicates the designed level of treatment is not being achieved, the stored effluent may be recirculated through the system for additional treatment prior to discharge. This recirculation will be accomplished through a series of valves and piping (Drawing 5).

Effluent tanks may be repurposed as influent storage tanks to accommodate periods of low-flow operations or peak contact stormwater generation to effectively manage influent source water quantities. The existing recirculation line can be used to transfer stored influent to the CSWTS.

TABLES

Table 1
Summary of Constituents in Expected Process Water
Bremo Power Station

			PZ-1 (North Pond)	PZ-2 (East Pond)	North Pond Toe Drain	Metals Pond
Source Water Type			Ash Dewatering Water		Toe Drain	Commingled Process and Stormwater
Parameter	Sample Date	Method				
Total Metals (ug/L)						
Aluminum	01/20/2015	SM3111D	--	--	--	--
Aluminum	03/31/2015	SW6010C	22200	249000	--	--
Aluminum	04/15/2015	SW6010C	9220	65100	244	--
Aluminum	05/21/2015	E200.7	76300	120000	--	76.1
Aluminum	06/04/2015	E200.7	24700	123000	< 20.0	334
Aluminum	06/16/2015	E200.7	--	--	< 20.0	--
Antimony	01/20/2015	SM3113B	--	--	--	--
Antimony	03/31/2015	SW6020A	11.7	13.4	--	--
Antimony	04/15/2015	SW6020A	13.5	8.79	0.715	0.355
Antimony	05/21/2015	E200.8	4.77	9.50	--	0.157
Antimony	06/04/2015	E200.8	4.73	7.97	< 0.110	0.247
Antimony	06/16/2015	E200.8	--	--	< 0.110	--
Arsenic	01/20/2015	SM3113B	--	--	--	--
Arsenic	03/31/2015	SW6010C	173	813	--	--
Arsenic	04/15/2015	SW6010C	265	425	< 6.80	--
Arsenic	05/21/2015	E200.8	1020	838	--	3.59
Arsenic	05/21/2015	E200.9	--	544	--	--
Arsenic	06/04/2015	E200.8	485	1460	< 0.610	8.57
Arsenic	06/04/2015	E200.9	--	511	--	--
Arsenic	06/16/2015	E200.8	--	--	< 0.610	--
Barium	01/20/2015	SM3113B	--	--	--	--
Barium	03/31/2015	SW6010C	758	9370	--	--
Barium	04/15/2015	SW6010C	844	2620	114	--
Barium	05/21/2015	E200.7	2510	3680	--	58.9
Barium	06/04/2015	E200.7	1260	3540	14.5	59.9
Barium	06/16/2015	E200.7	--	--	13.4	--
Beryllium	01/20/2015	SM3113B	--	--	--	--
Beryllium	03/31/2015	SW6010C	5.54	87.7	--	--
Beryllium	04/15/2015	SW6010C	3.14	31.9	< 0.100	--
Beryllium	05/21/2015	E200.7	22.6	57.0	--	< 2.0
Beryllium	06/04/2015	E200.7	6.8	64.9	< 2.0	< 2.0
Beryllium	06/16/2015	E200.7	--	--	< 2.0	--
Boron	03/31/2015	SW6010C	1320	2190	--	--
Boron	04/15/2015	SW6010C	2790	2190	396	230
Boron	05/21/2015	E200.7	1630	1750	--	217
Boron	06/04/2015	E200.7	1740	1890	774	238
Boron	06/16/2015	E200.7	--	--	777	--
Cadmium	01/20/2015	SM3113B	--	--	--	--
Cadmium	03/31/2015	SW6010C	< 0.360	1.36	--	--
Cadmium	04/15/2015	SW6010C	< 0.360	1.33	< 0.360	< 0.360
Cadmium	05/21/2015	E200.8	2.26	9.41	--	< 0.110
Cadmium	06/04/2015	E200.8	0.636	11.5	< 0.110	< 0.110
Cadmium	06/16/2015	E200.8	--	--	< 0.110	--
Chromium	01/20/2015	SM3113B	--	--	--	--
Chromium	03/31/2015	SW6010C	32.3	366	--	--
Chromium	04/15/2015	SW6010C	20.5	150	< 1.40	< 1.40
Chromium	05/21/2015	E200.8	112	342	--	0.498
Chromium	06/04/2015	E200.8	23.6	557	< 0.450	3.08
Chromium	06/16/2015	E200.8	--	--	< 0.450	--

Table 1
Summary of Constituents in Expected Process Water
Bremo Power Station

			PZ-1 (North Pond)	PZ-2 (East Pond)	North Pond Toe Drain	Metals Pond
Source Water Type			Ash Dewatering Water		Toe Drain	Commingled Process and Stormwater
Chromium (III)	05/21/2015	CALC	112	342	--	< 5
Chromium (III)	06/04/2015	CALC	24	557	< 5	< 5
Chromium (III)	06/16/2015	CALC	--	--	< 5	--
Cobalt	01/20/2015	SM3113B	--	--	--	--
Cobalt	03/31/2015	SW6010C	25.5	265	--	--
Cobalt	04/15/2015	SW6010C	13.6	79.7	< 1.10	--
Cobalt	05/21/2015	E200.7	77.6	167	--	< 2.0
Cobalt	06/04/2015	E200.7	29.4	174	< 2.0	5.5
Cobalt	06/16/2015	E200.7	--	--	< 2.0	--
Copper	01/20/2015	SM3113B	--	--	--	--
Copper	03/31/2015	SW6010C	86.6	1050	--	--
Copper	04/15/2015	SW6010C	57.7	404	2.81	4.04
Copper	05/21/2015	E200.8	363	1110	--	1.63
Copper	05/21/2015	E200.9	--	806	--	--
Copper	06/04/2015	E200.8	70.3	1780	< 0.220	6.05
Copper	06/04/2015	E200.9	--	853	--	--
Copper	06/16/2015	E200.8	--	--	0.681	--
Hexavalent Chromium	04/15/2015	SM3500-CR-B	< 8.8	16	17	< 8.8
Hexavalent Chromium	05/21/2015	SM3500-CR-B	< 50	< 25	--	< 5
Hexavalent Chromium	06/04/2015	SM3500-CR-B	< 25	< 100	< 5	< 5
Hexavalent Chromium	06/16/2015	SM3500-CR-B	--	--	< 5	--
Iron	01/20/2015	SM3111B	--	--	--	--
Iron	03/31/2015	SW6010C	10700	103000	--	--
Iron	04/15/2015	SW6010C	4070	22600	1030	142
Iron	05/21/2015	E200.7	27800	29800	--	548
Iron	06/04/2015	E200.7	8930	30600	12.7	1410
Iron	06/16/2015	E200.7	--	--	3.6	--
Lead	01/20/2015	SM3113B	--	--	--	--
Lead	03/31/2015	SW6010C	28.8	336	--	--
Lead	04/15/2015	SW6010C	15.9	77.2	< 3.10	< 3.10
Lead	05/21/2015	E200.8	152	244	--	< 0.160
Lead	06/04/2015	E200.8	35.6	579	< 0.160	1.47
Lead	06/16/2015	E200.8	--	--	< 0.160	--
Mercury	01/20/2015	SM3112B	--	--	--	--
Mercury	03/31/2015	SW7470A	< 0.170	0.862	--	--
Mercury	04/15/2015	SW7470A	< 0.170	0.361	< 0.170	< 0.170
Mercury	05/21/2015	E245.1	0.189	1.86	--	< 0.023
Mercury	06/04/2015	E245.1	< 0.023	5.39	0.147	< 0.023
Mercury	06/16/2015	E245.1	--	--	< 0.023	--
Molybdenum	01/20/2015	SM3113B	--	--	--	--
Molybdenum	03/31/2015	SW6010C	226	64.9	--	--
Molybdenum	04/15/2015	SW6010C	305	32.6	< 2.50	--
Molybdenum	05/21/2015	E200.7	52.6	< 50.0	--	< 50.0
Molybdenum	06/04/2015	E200.7	92.5	< 50.0	< 50.0	< 50.0
Molybdenum	06/16/2015	E200.7	--	--	< 50.0	--

Table 1
Summary of Constituents in Expected Process Water
Bremo Power Station

Source Water Type			PZ-1 (North Pond)	PZ-2 (East Pond)	North Pond Toe Drain	Metals Pond
			Ash Dewatering Water		Toe Drain	Commingled Process and Stormwater
Nickel	01/20/2015	SM3113B	--	--	--	--
Nickel	03/31/2015	SW6010C	40.5	430	--	--
Nickel	04/15/2015	SW6010C	30.3	135	7.55	15.1
Nickel	05/21/2015	E200.8	126	332	--	11.4
Nickel	06/04/2015	E200.8	31.0	625	0.403	20.3
Nickel	06/16/2015	E200.8	--	--	0.527	--
Selenium	01/20/2015	SM3113B	--	--	--	--
Selenium	03/31/2015	SW6010C	< 5.00	90.0	--	--
Selenium	04/15/2015	SW6010C	< 5.00	15.1	< 5.00	< 5.00
Selenium	05/21/2015	E200.8	< 13.0	35.3	--	5.48
Selenium	06/04/2015	E200.8	< 3.25	144	< 0.650	10.6
Selenium	06/16/2015	E200.8	--	--	< 0.650	--
Silver	01/20/2015	SM3113B	--	--	--	--
Silver	03/31/2015	SW6020A	< 0.500	< 1.00	--	--
Silver	04/15/2015	SW6010C	< 1.90	< 1.90	< 1.90	< 1.90
Silver	05/21/2015	E200.8	< 0.580	< 0.870	--	< 0.029
Silver	06/04/2015	E200.8	< 0.145	< 0.870	< 0.029	< 0.029
Silver	06/16/2015	E200.8	--	--	< 0.029	--
Thallium	01/20/2015	E279.2	--	--	--	--
Thallium	03/31/2015	SW6020A	1.91	11.4	--	--
Thallium	04/15/2015	SW6020A	0.818	9.12	< 0.110	0.141
Thallium	05/21/2015	E200.8	7.96	26.4	--	< 0.058
Thallium	06/04/2015	E200.8	1.78	46.4	< 0.058	0.096
Thallium	06/16/2015	E200.8	--	--	< 0.058	--
Vanadium	03/31/2015	SW6010C	176	1420	--	--
Vanadium	04/15/2015	SW6010C	159	796	< 1.40	--
Vanadium	05/21/2015	E200.7	407	718	--	< 2.0
Vanadium	06/04/2015	E200.7	131	1080	< 2.0	< 2.0
Vanadium	06/16/2015	E200.7	--	--	< 2.0	--
Zinc	01/20/2015	SM3111B	--	--	--	--
Zinc	03/31/2015	SW6010C	58.1	447	--	--
Zinc	04/15/2015	SW6010C	35.5	167	< 3.80	< 3.80
Zinc	05/21/2015	E200.8	228	491	--	16.9
Zinc	06/04/2015	E200.8	47.2	943	< 1.60	9.35
Zinc	06/16/2015	E200.8	--	--	5.50	--
WQ/Other (ug/L)						
Ammonia	03/31/2015	E350.1	220	280	--	--
Ammonia	04/15/2015	E350.1	330	310	< 45	< 45
Ammonia Nitrogen	01/20/2015	SM4500-NH3-D	--	--	--	--
Ammonia Nitrogen	05/21/2015	E350.1	460	210	--	90
Ammonia Nitrogen	06/04/2015	E350.1	--	--	< 50	--
Ammonia Nitrogen	06/16/2015	E350.1	--	--	< 50	--
Chloride	01/20/2015	E300	--	--	--	--
Chloride	03/31/2015	E300	15000	5500	--	--
Chloride	04/15/2015	E300	17000	4100	9700	3800
Chloride	05/21/2015	E300.0A	12300	2900	--	< 1000
Chloride	06/04/2015	E300.0A	--	--	11800	--
Chloride	06/16/2015	E300.0A	--	--	11600	--

**Table 1
Summary of Constituents in Expected Process Water
Brevo Power Station**

			PZ-1 (North Pond)	PZ-2 (East Pond)	North Pond Toe Drain	Metals Pond
Source Water Type			Ash Dewatering Water		Toe Drain	Commingled Process and Stormwater
Cyanide	01/20/2015	SM4500-CN-E	--	--	--	--
Cyanide	05/21/2015	SM4500-CN-E	< 10	< 10	--	12
Cyanide	06/04/2015	SM4500-CN-E	< 10	< 10	< 10	< 10
Cyanide	06/16/2015	SM4500-CN-E	--	--	< 10	--
Hardness	04/15/2015	SM2340B	450000	570000	130000	--
Hardness	05/21/2015	SM2340B	476000	628000	--	313000
Hardness	06/04/2015	SM2340B	438000	764000	80000	330000
Hardness	06/16/2015	SM2340B	--	--	78300	--
Oil & Grease, Total Rec	01/20/2015	E1664B	--	--	--	--
Oil & Grease, Total Rec	03/31/2015	E1664B	< 2400	< 2400	--	--
Oil & Grease, Total Rec	04/15/2015	E1664B	< 2400	< 2400	< 2400	< 2400
Oil & Grease, Total Rec	05/21/2015	E1664A	< 5000	< 5000	--	< 5000
Oil & Grease, Total Rec	06/04/2015	E1664A	--	--	< 5200	--
Oil & Grease, Total Rec	06/16/2015	E1664A	--	--	< 5000	--
Total Suspended Solids	01/20/2015	SM4500-P-E	--	--	--	--
Total Suspended Solids	03/31/2015	SM2540D	1100000	2400000	--	--
Total Suspended Solids	04/15/2015	SM2540D	750000	1300000	4300	< 2500
Total Suspended Solids	05/21/2015	SM2540D	5640000	5120000	--	3000
Total Suspended Solids	06/04/2015	SM2540B	--	--	175000	--
Total Suspended Solids	06/04/2015	SM2540D	--	--	< 1000	--
Total Suspended Solids	06/16/2015	SM2540D	--	--	< 1000	--

ug/L - microgram per liter

Table 2
Statistical Summary of Constituents in Process Water
Bremo Power Station

	PZ-1 (North Pond)		PZ-2 (East Pond)		North Pond Toe Drain		Metals Pond	
Source Water Type	Ash Dewatering Water				Toe Drain		Commingled Process and Stormwater	
Parameter	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Total Metals (ug/L)								
Aluminum	33100	76300	139000	249000	81.3	244	205	334
Antimony	8.68	13.5	9.92	13.4	0.238	0.715	0.253	0.355
Arsenic	486	1020	765	1460	0	0	6.08	8.57
Barium	1340	2510	4800	9370	47.3	114	59.4	59.9
Beryllium	9.52	22.6	60.4	87.7	0	0	0	0
Boron	1870	2790	2010	2190	649	777	228	238
Cadmium	0.724	2.26	5.9	11.5	0	0	0	0
Chromium	47.1	112	354	557	0	0	1.19	3.08
Chromium (III)	68	112	450	557	0	0	0	0
Cobalt	36.5	77.6	171	265	0	0	2.8	5.5
Copper	144	363	1000	1780	1.16	2.81	3.91	6.05
Hexavalent Chromium	0	0	5.3	16	5.7	17	0	0
Iron	12900	27800	46500	103000	349	1030	700	1410
Lead	58.1	152	309	579	0	0	0.49	1.47
Mercury	0.0473	0.189	2.12	5.39	0.049	0.147	0	0
Molybdenum	169	305	24.4	64.9	0	0	0	0
Nickel	57	126	381	625	2.83	7.55	15.6	20.3
Selenium	0	0	71.1	144	0	0	5.36	10.6
Silver	0	0	0	0	0	0	0	0
Thallium	3.12	7.96	23.3	46.4	0	0	0.079	0.141
Vanadium	218	407	1000	1420	0	0	0	0
Zinc	92.2	228	512	943	1.83	5.5	8.75	16.9
WQ/Other (ug/L)								
Ammonia	280	330	300	310	0	0	0	0
Ammonia Nitrogen	460	460	210	210	0	0	90	90
Chloride	14800	17000	4200	5500	11000	11800	1900	3800
Cyanide	0	0	0	0	0	0	6	12
Hardness	455000	476000	654000	764000	96100	130000	322000	330000
Oil & Grease, Total Rec	0	0	0	0	0	0	0	0
Total Suspended Solids	2500000	5640000	14000000	24000000	44800	175000	2000	3000

ug/L - microgram per liter

Zero value used in place of all non-detected parameters

Table 3 - Summary of Pre-Permit North Pond Water Sampling Results
Bremo Power Station, Fluvanna, Virginia

Analyte	Method	Date	Units	Detection Limit	Reporting Limit	Outfall 500's Monthly Average	Outfall 500's Monthly Minimum	Outfall 500's Monthly Maximum	NP Catwalk 1'	NP Catwalk 4'	NP Pool
									Depth' Results	Depth' Results	Results
pH	Field	10/30/2015	S.U.	0.1	0.1	None	6.0	9.0	8.17	8.02	--
	Field	11/2/2015	S.U.	0.1	0.1	None	6.0	9.0	8.43	--	8.34
	Field	11/3/2015	S.U.	0.1	0.1	None	6.0	9.0	8.44	--	8.22
	Field	11/5/2015	S.U.	0.1	0.1	None	6.0	9.0	8.1	--	8.4
	Field	11/17/2015	S.U.	0.1	0.1	None	6.0	9.0	7.65	7.83	7.86
	Field	12/1/2015	S.U.	0.1	0.1	None	6.0	9.0	8.5	8.4	8.6
	Field	12/2/2015	S.U.	0.1	0.1	None	6.0	9.0	8.2	--	8.1
	Field	12/4/2015	S.U.	0.1	0.1	None	6.0	9.0	8.5	--	8.4
	Field	1/6/2015	S.U.	0.1	0.1	None	6.0	9.0	--	--	8.2
Oil and Grease	HEM	10/30/2015	mg/L	1.1	5.0	15.0	No Limit	20.0	ND	ND	--
	HEM	11/2/2015	mg/L	1.1	5.0	15.0	No Limit	20.0	--	--	ND
	HEM	11/17/2015	mg/L	1.1	5.0	15.0	No Limit	20.0	ND	ND	ND
	HEM	12/1/2015	mg/L	1.1	5.0	15.0	No Limit	20.0	ND	ND	ND
	HEM	1/6/2015	mg/L	1.1	5.0	15.0	No Limit	20.0	--	--	ND
Antimony	200.7	10/30/2015	ug/L	3.9	5.0	2,100	No Limit	2,100	5.7	6.2	--
	200.7	11/2/2015	ug/L	3.9	5.0	2,100	No Limit	2,100	--	--	5.9
	200.7	11/17/2015	ug/L	3.9	5.0	2,100	No Limit	2,100	4.3, J	4.8, J	4.0, J
	200.7	12/1/2015	ug/L	3.9	5.0	2,100	No Limit	2,100	5.4	5.0, J	4.3, J
	200.7	1/6/2015	ug/L	3.9	5.0	2,100	No Limit	2,100	--	--	ND
Arsenic	200.7	10/30/2015	ug/L	5.0	10.0	290	No Limit	530	64.8	65.2	--
	200.7	11/2/2015	ug/L	5.0	10.0	290	No Limit	530	--	--	58.7
	200.7	11/17/2015	ug/L	5.0	10.0	290	No Limit	530	48.4	43.7	48.9
	200.7	12/1/2015	ug/L	5.0	10.0	290	No Limit	530	39.8	41.3	38
	200.7	1/6/2015	ug/L	5.0	10.0	290	No Limit	530	--	--	30.8
Cadmium	200.7	10/30/2015	ug/L	0.50	1.0	1.8	No Limit	3.2	ND	ND	--
	200.7	11/2/2015	ug/L	0.50	1.0	1.8	No Limit	3.2	--	--	ND
	200.7	11/17/2015	ug/L	0.50	1.0	1.8	No Limit	3.2	ND	ND	ND
	200.7	12/1/2015	ug/L	0.50	1.0	1.8	No Limit	3.2	ND	ND	ND
	200.7	1/6/2015	ug/L	0.50	1.0	1.8	No Limit	3.2	--	--	ND
Chromium, total	200.7	10/30/2015	ug/L	2.5	5.0	No Limit	No Limit	No Limit	ND	ND	--
	200.7	11/2/2015	ug/L	2.5	5.0	No Limit	No Limit	No Limit	--	--	ND
	200.7	11/17/2015	ug/L	2.5	5.0	No Limit	No Limit	No Limit	ND	ND	ND
	200.7	12/1/2015	ug/L	2.5	5.0	No Limit	No Limit	No Limit	ND	ND	ND
	200.7	1/6/2015	ug/L	2.5	5.0	No Limit	No Limit	No Limit	--	--	ND
Chromium, trivalent	calculated	10/30/2015	ug/L	NA	NA	120	No Limit	220	ND	ND	--
	calculated	11/2/2015	ug/L	NA	NA	120	No Limit	220	--	--	ND
	calculated	11/17/2015	ug/L	NA	NA	120	No Limit	220	ND	ND	ND
	calculated	12/1/2015	ug/L	NA	NA	120	No Limit	220	ND	ND	ND
	calculated	1/6/2015	ug/L	NA	NA	120	No Limit	220	--	--	ND

Table 3 - Summary of Pre-Permit North Pond Water Sampling Results
Bremon Power Station, Fluvanna, Virginia

Analyte	Method	Date	Units	Detection Limit	Reporting Limit	Outfall 500's Monthly Average	Outfall 500's Monthly Minimum	Outfall 500's Monthly Maximum	NP Catwalk 1' Depth'	NP Catwalk 4' Depth	NP Pool
									Results	Results	Results
Chromium, Hexavalent	SM-3500-Cr-B	10/30/2015	ug/L	5.0	10.0	18	No Limit	34	ND	ND	--
	SM-3500-Cr-B	11/2/2015	ug/L	5.0	10.0	18	No Limit	34	--	--	ND
	SM-3500-Cr-B	11/17/2015	ug/L	5.0	10.0	18	No Limit	34	ND	ND	ND
	SM-3500-Cr-B	12/1/2015	ug/L	5.0	10.0	18	No Limit	34	ND	ND	ND
	SM-3500-Cr-B	1/6/2015	ug/L	5.0	10.0	18	No Limit	34	--	--	ND
Copper	200.8	10/30/2015	ug/L	0.50	1.0	12	No Limit	23	7.1	1.5	--
	200.8	11/2/2015	ug/L	0.50	1.0	12	No Limit	23	--	--	1.4
	200.8	11/17/2015	ug/L	0.50	1.0	12	No Limit	23	2.5	2.8	2.2
	200.8	12/1/2015	ug/L	0.50	1.0	12	No Limit	23	1.4	1.4	1.4
	200.8	1/6/2015	ug/L	0.50	1.0	12	No Limit	23	--	--	1.8
Lead	200.7	10/30/2015	ug/L	2.5	5.0	19	No Limit	35	ND	ND	--
	200.7	11/2/2015	ug/L	2.5	5.0	19	No Limit	35	--	--	ND
	200.7	11/17/2015	ug/L	2.5	5.0	19	No Limit	35	ND	ND	ND
	200.7	12/1/2015	ug/L	2.5	5.0	19	No Limit	35	ND	ND	ND
	200.7	1/6/2015	ug/L	2.5	5.0	19	No Limit	35	--	--	ND
Mercury	245.1	10/30/2015	ug/L	0.070	0.20	1.5	No Limit	2.8	ND	ND	--
	245.1	11/2/2015	ug/L	0.070	0.20	1.5	No Limit	2.8	--	--	ND
	245.1	11/17/2015	ug/L	0.070	0.20	1.5	No Limit	2.8	ND	ND	ND
	245.1	12/1/2015	ug/L	0.070	0.20	1.5	No Limit	2.8	ND	ND	ND
	245.1	1/6/2015	ug/L	0.070	0.20	1.5	No Limit	2.8	--	--	ND
Nickel	200.7	10/30/2015	ug/L	2.5	5.0	31	No Limit	57	ND	ND	--
	200.7	11/2/2015	ug/L	2.5	5.0	31	No Limit	57	--	--	ND
	200.7	11/17/2015	ug/L	2.5	5.0	31	No Limit	57	ND	ND	2.5, J
	200.7	12/1/2015	ug/L	2.5	5.0	31	No Limit	57	ND	ND	ND
	200.7	1/6/2015	ug/L	2.5	5.0	31	No Limit	57	--	--	ND
Selenium	200.7	10/30/2015	ug/L	5.0	10.0	9.6	No Limit	18	ND	ND	--
	200.7	11/2/2015	ug/L	5.0	10.0	9.6	No Limit	18	--	--	ND
	200.7	11/17/2015	ug/L	5.0	10.0	9.6	No Limit	18	ND	ND	ND
	200.7	12/1/2015	ug/L	5.0	10.0	9.6	No Limit	18	ND	ND	ND
	200.7	1/6/2015	ug/L	5.0	10.0	9.6	No Limit	18	--	--	ND
Silver	200.8	10/30/2015	ug/L	0.050	0.10	2.7	No Limit	5.0	ND	ND	--
	200.8	11/2/2015	ug/L	0.050	0.10	2.7	No Limit	5.0	--	--	ND
	200.8	11/17/2015	ug/L	0.050	0.10	2.7	No Limit	5.0	ND	ND	ND
	200.8	12/1/2015	ug/L	0.050	0.10	2.7	No Limit	5.0	ND	ND	ND
	200.8	1/6/2015	ug/L	0.050	0.10	2.7	No Limit	5.0	--	--	ND

Table 3 - Summary of Pre-Permit North Pond Water Sampling Results
Bremon Power Station, Fluvanna, Virginia

Analyte	Method	Date	Units	Detection Limit	Reporting Limit	Outfall 500's Monthly Average	Outfall 500's Monthly Minimum	Outfall 500's Monthly Maximum	NP Catwalk 1' Depth'	NP Catwalk 4' Depth'	NP Pool
									Results	Results	Results
Thallium	200.8	10/30/2015	ug/L	0.50	1.0	1.4	No Limit	1.4	ND	ND	--
	200.8	11/2/2015	ug/L	0.50	1.0	1.4	No Limit	1.4	--	--	ND
	200.8	11/17/2015	ug/L	0.50	1.0	1.4	No Limit	1.4	ND	ND	ND
	200.8	12/1/2015	ug/L	0.50	1.0	1.4	No Limit	1.4	ND	ND	ND
	200.8	1/6/2015	ug/L	0.50	1.0	1.4	No Limit	1.4	--	--	ND
Zinc	200.7	10/30/2015	ug/L	2.5	10.0	110	No Limit	210	2.8, J	11.5	--
	200.7	11/2/2015	ug/L	2.5	10.0	110	No Limit	210	--	--	ND
	200.7	11/17/2015	ug/L	2.5	10.0	110	No Limit	210	9.2, J	5.8, J	3.9, J
	200.7	12/1/2015	ug/L	2.5	10.0	110	No Limit	210	7.3, J	ND	ND
	200.7	1/6/2015	ug/L	2.5	10.0	110	No Limit	210	--	--	9.8, J
Hardness as CaCO3	SM-2340B	10/30/2015	ug/L	662	662	No Limit	No Limit	No Limit	84,000	82,600	--
	SM-2340B	11/2/2015	ug/L	662	662	No Limit	No Limit	No Limit	--	--	91,300
	SM-2340B	11/17/2015	ug/L	662	662	No Limit	No Limit	No Limit	83,300	83,700	82,700
	SM-2340B	12/1/2015	ug/L	662	662	No Limit	No Limit	No Limit	85,900	87,200	84,900
	SM-2340B	1/6/2015	ug/L	662	662	No Limit	No Limit	No Limit	--	--	82,600
Turbidity	180.1	10/30/2015	NTU	0.50	1.0	No Limit	No Limit	No Limit	1.9	3.0	--
	180.1	11/2/2015	NTU	0.50	1.0	No Limit	No Limit	No Limit	--	--	1.9
	180.1	11/17/2015	NTU	0.50	1.0	No Limit	No Limit	No Limit	28.0	30.0	25.0
	180.1	12/1/2015	NTU	0.50	1.0	No Limit	No Limit	No Limit	5.56	6.49	5.69
	180.1	12/2/2015	NTU	0.05	1.0	No Limit	No Limit	No Limit	10.5	--	15.5
	180.1	12/4/2015	NTU	0.50	1.0	No Limit	No Limit	No Limit	10.3	--	9.37
	180.1	1/6/2015	NTU	0.50	1.0	No Limit	No Limit	No Limit	--	--	5.20
Total Suspended Solids	SM-2540D	10/30/2015	mg/L	1.2	1.2	30.0	No Limit	100.0	4.1	5.7	--
	SM-2540D	11/2/2015	mg/L	1.0	1.0	30.0	No Limit	100.0	--	--	2.7
	SM-2540D	11/17/2015	mg/L	1.0	1.0	30.0	No Limit	100.0	9.8	8.7	7.1
	SM-2540D	12/1/2015	mg/L	1.0	1.0	30.0	No Limit	100.0	ND	2.1	2.9
	SM-2540D	1/6/2015	mg/L	2.0	2.0	30.0	No Limit	100.0	--	--	ND
Ammonia - N	350.1	10/30/2015	mg/L	0.0050	0.010	9.6	No Limit	14	ND	ND	--
	350.1	11/2/2015	mg/L	0.0050	0.010	9.6	No Limit	14	--	--	0.0070, J
	350.1	11/17/2015	mg/L	0.0050	0.010	9.6	No Limit	14	0.19	0.28	0.25
	350.1	12/1/2015	mg/L	0.0050	0.010	9.6	No Limit	14	0.031	0.041	0.089
	350.1	1/6/2015	mg/L	0.0050	0.010	9.6	No Limit	14	--	--	ND

Table 3 - Summary of Pre-Permit North Pond Water Sampling Results
Brema Power Station, Fluvanna, Virginia

Analyte	Method	Date	Units	Detection Limit	Reporting Limit	Outfall 500's Monthly Average	Outfall 500's Monthly Minimum	Outfall 500's Monthly Maximum	NP Catwalk 1' Depth'	NP Catwalk 4' Depth	NP Pool
									Results	Results	Results
Chloride	SM-4500-CL-E	10/30/2015	mg/L	0.50	1.0	450	No Limit	820	12.3	11.9	--
	SM-4500-CL-E	11/2/2015	mg/L	0.50	1.0	450	No Limit	820	--	--	11.9
	SM-4500-CL-E	11/17/2015	mg/L	0.50	1.0	450	No Limit	820	10.8	10.9	11.0
	SM-4500-CL-E	12/1/2015	mg/L	0.50	1.0	450	No Limit	820	10.2	10.6	11.3
	SM-4500-CL-E	1/6/2015	mg/L	0.50	1.0	450	No Limit	820	--	--	9.3
Acute WET (<i>Ceriodaphnia dubia</i>)	2002.0	11/2/2015	% ^C	--	--	No Limit	100	No Limit	100	--	100
(Daphnid)	2002.0	12/1/2015	% ^C	--	--	No Limit	100	No Limit	100	--	100
Chronic WET (<i>Ceriodaphnia dubia</i>)	1002.0	11/2/2015	TU _c	--	--	No Limit	No Limit	6.25	1.00	--	1.00
(Daphnid)	1002.0	12/1/2015	TU _c	--	--	No Limit	No Limit	6.25	1.00	--	1.00
Acute WET (<i>Pimephales promelas</i>)	2000.0	11/2/2015	% ^C	--	--	No Limit	100	No Limit	100	--	100
(Fathead Minnow)	2000.0	12/1/2015	% ^C	--	--	No Limit	100	No Limit	100	--	100
Chronic WET (<i>Pimephales promelas</i>)	1000.0	11/2/2015	TU _c	--	--	No Limit	No Limit	6.25	1.00	--	1.00
(Fathead Minnow)	1000.0	12/1/2015	TU _c	--	--	No Limit	No Limit	6.25	1.00	--	1.00

Notes:

ug/L = micrograms per liter

mg/L = milligrams per liter

SU = Standard Units

"--" = No Data

ND = Not Detected at the indicated detection limit

TU_c = Toxicity Units (the relative toxicity of an effluent, the larger the T.U. value the more toxic the effluent) (100/NOEC)

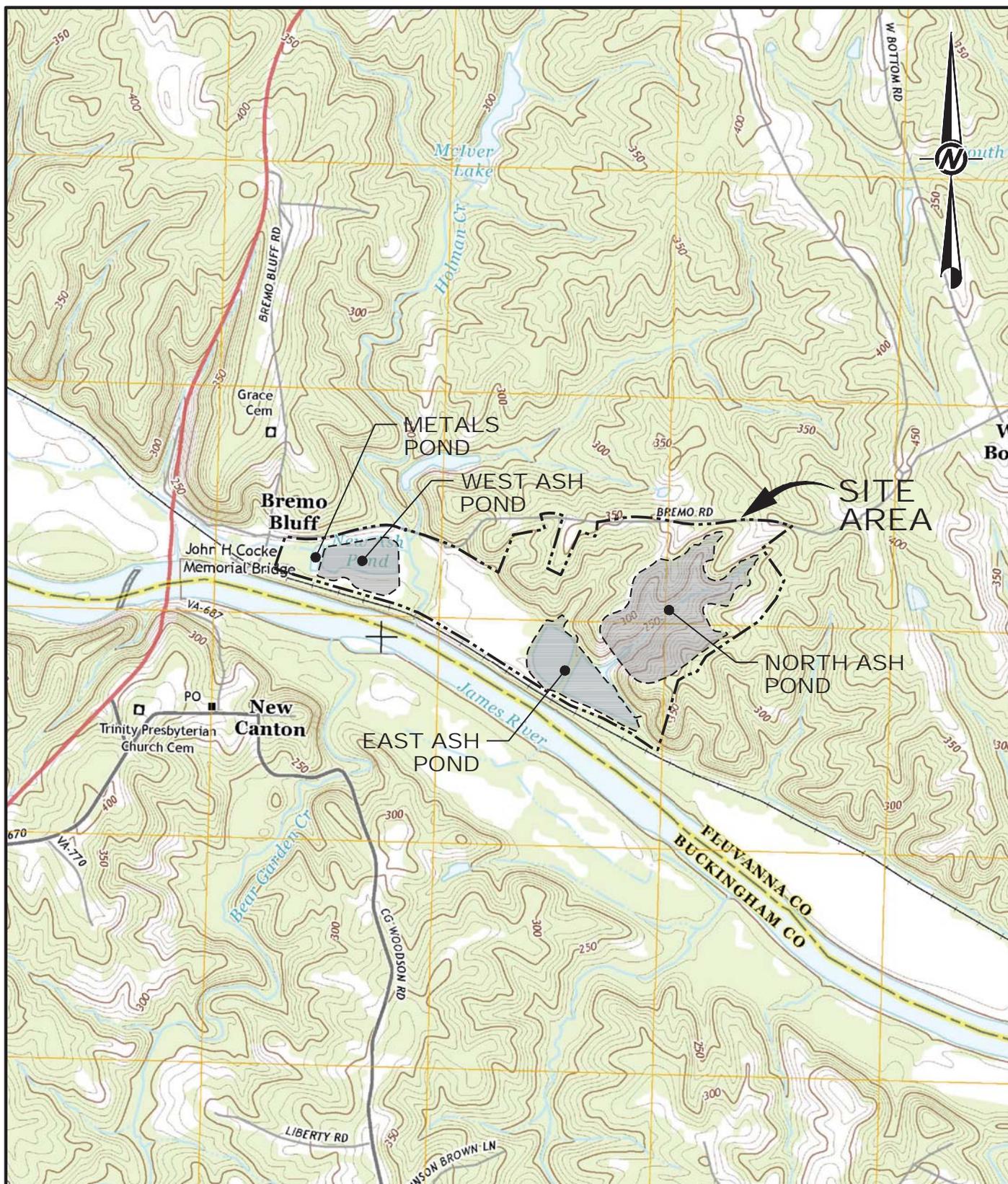
%^C = The highest concentration of sample in an acute test at which organisms exhibit no significant reduction in any of the test end points (e.g. growth, survival, reproduction) (NOAEC)

Table 4
Summary of CSWTS Process Chemicals
Bremo Power Station

Process Category	Type
<u>Oxidation Chemicals</u>	Aeration Sodium Hypochlorite Hydrogen Peroxide
<u>Coagulants</u>	WC-500 Ferric Chloride Alum Sodium Sulfide
<u>Flocculents</u>	Adega AP-210 Adega CP-120
<u>pH Adjustment Chemicals</u>	Sodium Hydroxide Low Freeze Sodium Hydroxide Potassium Hydroxide Hydrochloric Acid Sulfuric Acid
<u>Reducing Agents</u>	Ferrous Sulfate

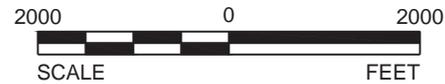
DRAWINGS

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REFERENCE

BASE MAP CONSISTS OF 7.5-MINUTE USGS TOPOGRAPHIC QUADRANGLE NAMED ARVONIA, VIRGINIA, DATED 2013.

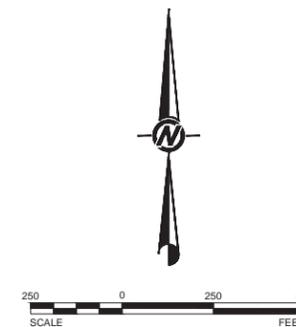


 Golder Associates Richmond, Virginia	DATE	12/18/15	TITLE	<h2>SITE LOCATION MAP</h2>
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	CADD	BPG		
PROJECT No.	15-20347	CHECK	DPM	<h3>DOMINION - BREMO POWER STATION</h3>
SCALE	AS SHOWN	REVIEW	JRD	

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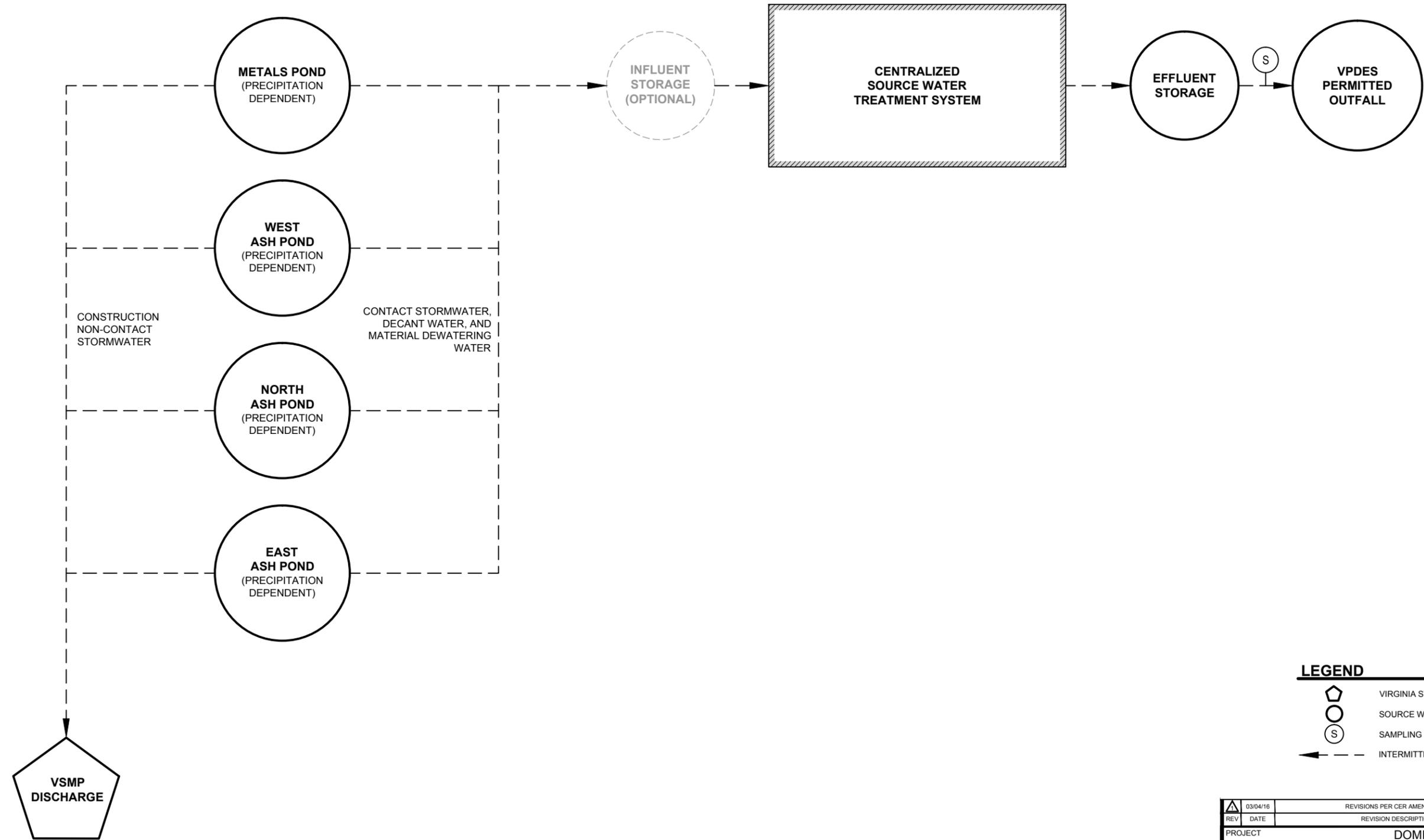
LEGEND	
	- APPROXIMATE PROPERTY BOUNDARY
	- APPROXIMATE LIMITS OF ASH POND
	- OUTFALL CONVEYANCE SYSTEM
	- WATER SAMPLING LOCATION



REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVV
PROJECT						
DOMINION BREMO POWER STATION CONCEPT ENGINEERING REPORT CENTRALIZED SOURCE WATER TREATMENT SYSTEM						
TITLE						
SITE PLAN						
PROJECT No.		15-20347	FILE No.		1520347P02	
DESIGN	JRD	12/18/15	SCALE	AS SHOWN		
CADD	ATN	12/18/15	DRAWING 2			
CHECK	ATN	12/18/15				
REVIEW	JRD	12/18/15				



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LEGEND

- VIRGINIA STORMWATER MANAGEMENT PROGRAM
- SOURCE WATER AND OUTFALLS
- SAMPLING LOCATION
- INTERMITTENT FLOW

REV	DATE	REVISIONS PER CER AMENDMENT	JRD	ATN	ATN	JRD
		REVISION DESCRIPTION	DES	CADD	CHK	RVV
PROJECT						
DOMINION BREMO POWER STATION CONCEPT ENGINEERING REPORT CENTRALIZED SOURCE WATER TREATMENT SYSTEM						
TITLE						
PROCESS FLOW DIAGRAM 2016-2018 TIME FRAME						
PROJECT No. 15-20347			FILE No. 1520347P03			
DESIGN	JRD	12/18/15	SCALE		AS SHOWN	
CADD	ATN	12/18/15				
CHECK	ATN	12/18/15				
REVIEW	JRD	12/18/15				



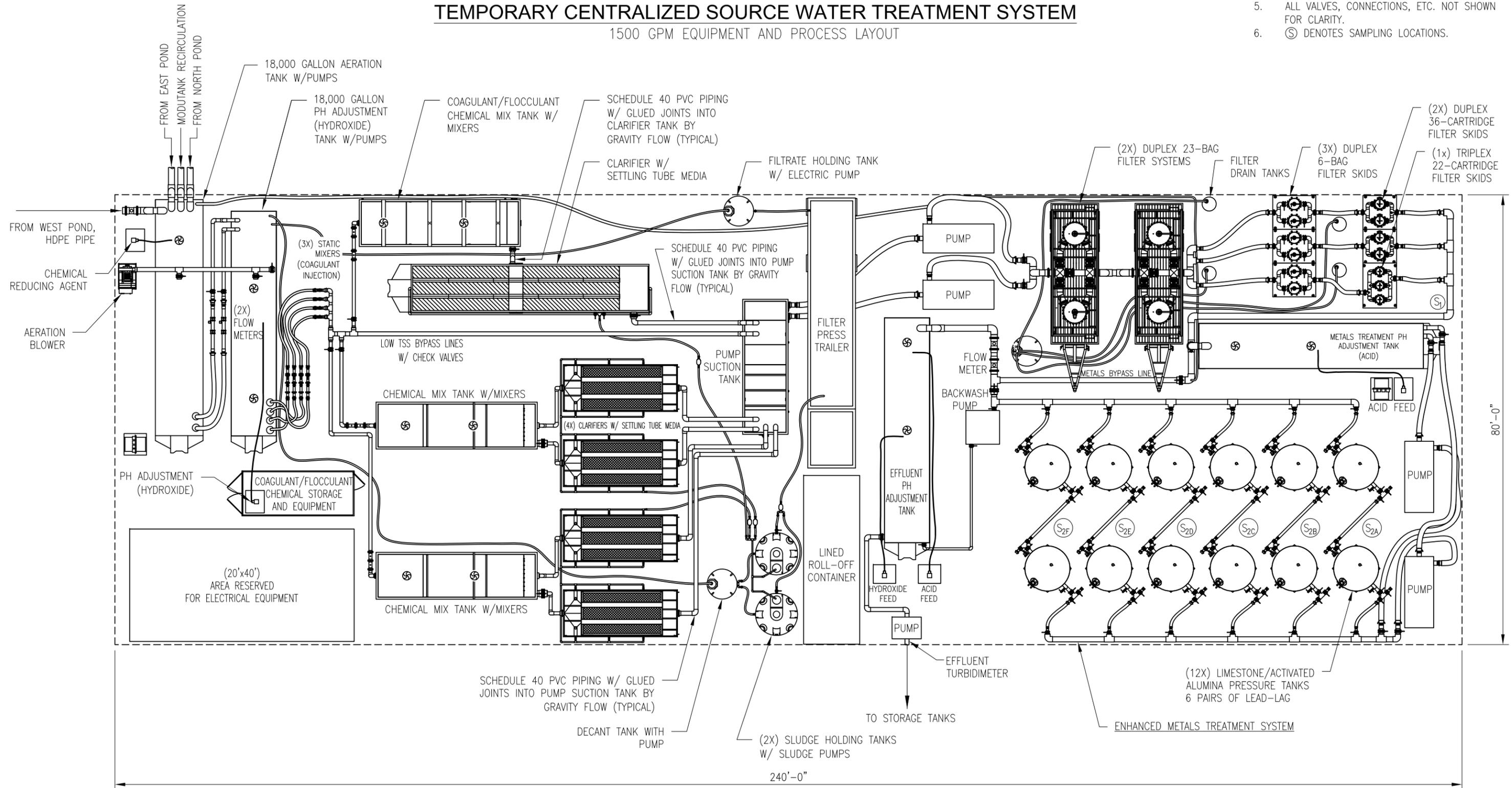
DRAWING 3

NOTES:

1. DRAWING DEPICTS GENERAL EQUIPMENT.
2. MAXIMUM FLOW RATE: 1500 GPM.
3. SYSTEM FOOTPRINT APPROXIMATELY 80'x240' (PARKING LOT LOCATION).
4. PIPING SHOWN FOR CONCEPTUAL PURPOSES.
5. ALL VALVES, CONNECTIONS, ETC. NOT SHOWN FOR CLARITY.
6. Ⓢ DENOTES SAMPLING LOCATIONS.

TEMPORARY CENTRALIZED SOURCE WATER TREATMENT SYSTEM

1500 GPM EQUIPMENT AND PROCESS LAYOUT



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SCALE: NTS

REV.	DATE	BY	REMARKS	REV.	DATE	BY	REMARKS
D	12/14/15	RJS	RE-ARRANGED EQUIPMENT				
C	12/04/15	RJS	SMALLER FOOTPRINT DESIGN				
B	12/01/15	RJS	SMALLER FOOTPRINT DESIGN	5	08/16/16	MSM	CER REVISION 4.
A	11/24/15	RJS	PRELIMINARY DESIGN.	4	12/18/15	RJS	ADDED SAMPLING LOCATIONS

CUSTOMER:	DOMINION
SITE:	BREMO, VA

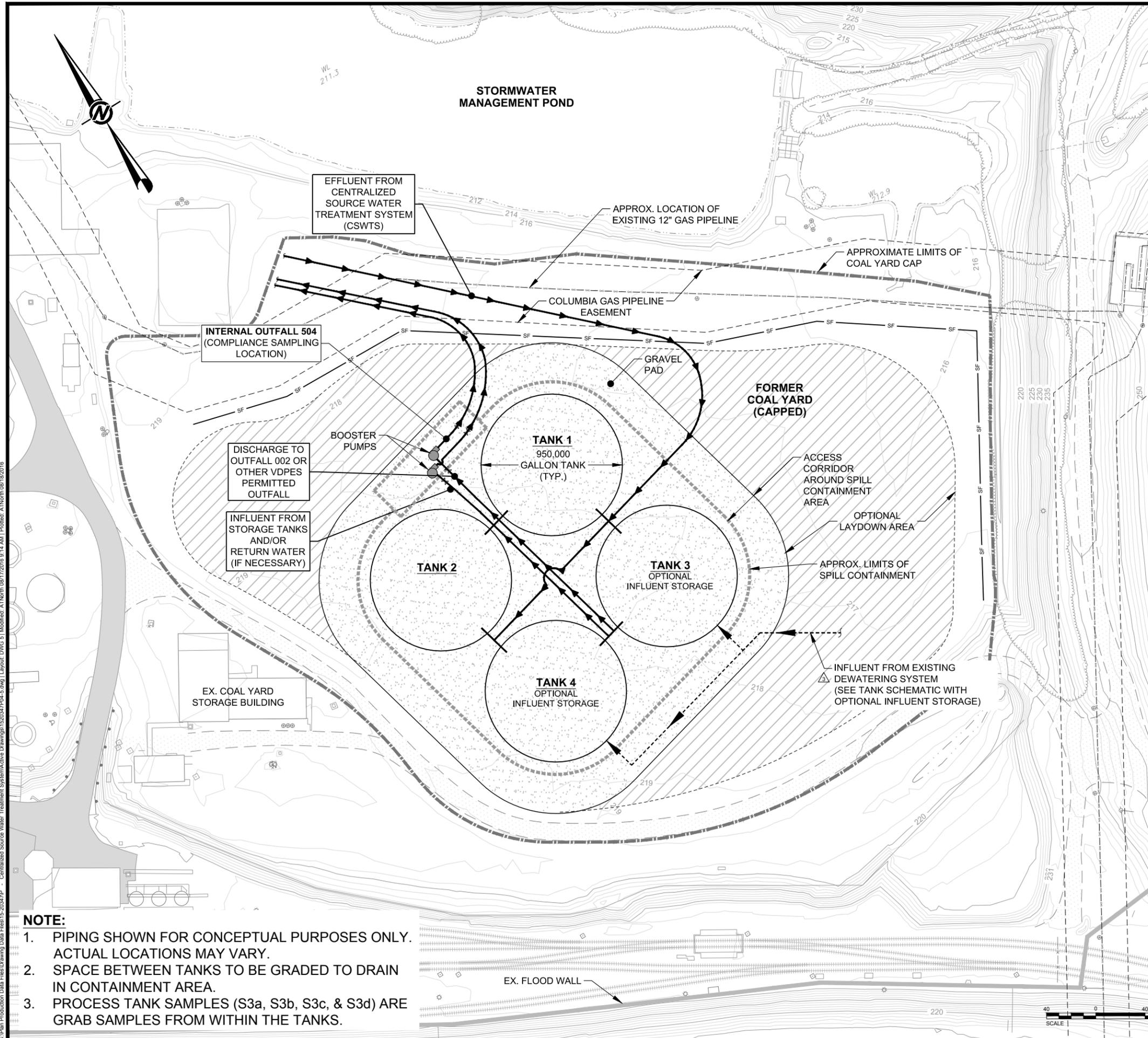
TITLE:	TEMPORARY TREATMENT SYSTEM 1500 GPM EQUIPMENT AND PROCESS LAYOUT
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DRAWN	BY: RJS	DATE: 11/24/15
APPROVED	BY: MFP	DATE: 12/14/15

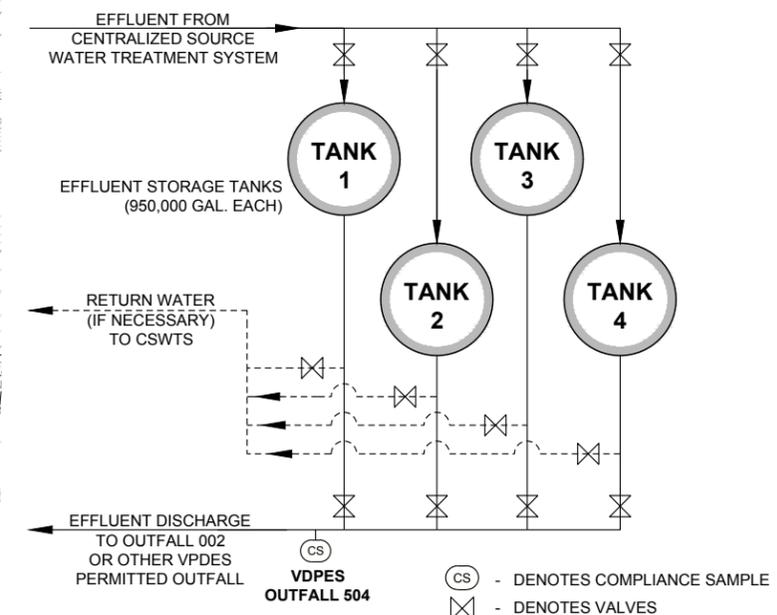


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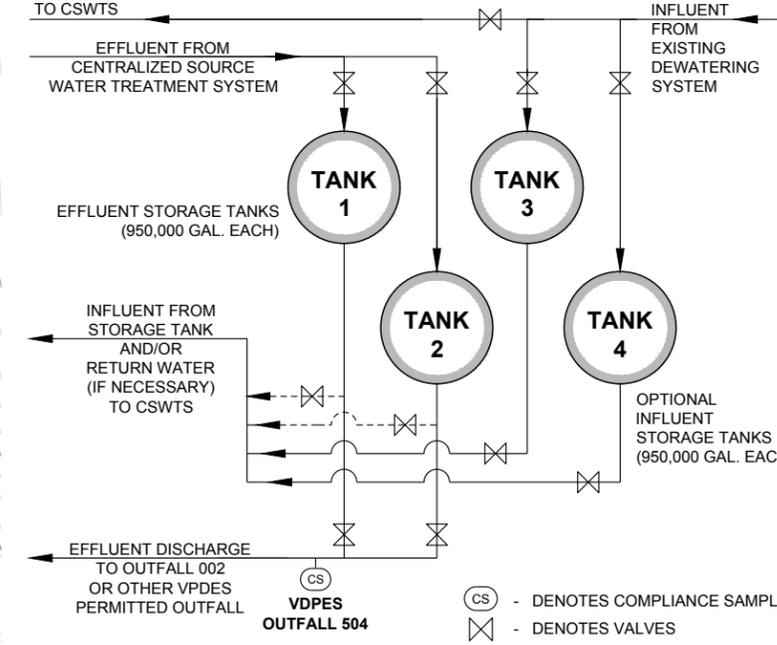
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TANK SCHEMATIC WITHOUT INFLUENT STORAGE



TANK SCHEMATIC WITH OPTIONAL INFLUENT STORAGE



- NOTE:**
1. PIPING SHOWN FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY.
 2. SPACE BETWEEN TANKS TO BE GRADED TO DRAIN IN CONTAINMENT AREA.
 3. PROCESS TANK SAMPLES (S3a, S3b, S3c, & S3d) ARE GRAB SAMPLES FROM WITHIN THE TANKS.

REV	DATE	REVISION DESCRIPTION	JRD	ATN	ATN	JRD
08/08/16		REVISED TO INCLUDE INFLUENT STORAGE TANK	JRD	ATN	ATN	JRD
03/23/16		PER DEQ COMMENTS	JRD	ATN	ATN	JRD
03/01/16		PER DEQ COMMENTS	JRD	ATN	ATN	JRD
DES	CADD	CHK	RVW			

PROJECT: DOMINION BREMO POWER STATION CONCEPT ENGINEERING REPORT CENTRALIZED SOURCE WATER TREATMENT SYSTEM

TITLE: **INFLUENT/EFFLUENT STORAGE PLAN**

PROJECT No.	15-20347	FILE No.	1520347P04-5
DESIGN	JRD	02/09/16	SCALE AS SHOWN
CADD	ATN	02/06/16	
CHECK	ATN	02/11/16	
REVIEW	JRD	02/11/16	

DRAWING 5



APPENDICES

APPENDIX A
BENCH-SCALE TESTING GUIDELINES FOR THE REDUCTION OF SEDIMENT AND COLLOIDAL PARTICLES



Bench-Scale Testing Guidelines

For the Reduction of Sediment and Colloidal Particles

Bench-scale testing is conducted to help develop and optimize chemical processes like coagulation and flocculation. Let's define coagulation and flocculation as the chemical reactions applied to enhance the agglomeration and filtration & settling characteristics of the insoluble particles to aid the removal of those particles from process water.

For the purposes of these testing procedures, we will consider coagulation as the reduction (i.e., neutralization) of electrostatic forces that cause particles to repel each other. By neutralizing the charge between particles, the forces that repel and keep particles in suspension are alleviated and the particles are allowed to settle out of solution. Flocculation will be generally considered the physical/chemical agglomeration of smaller precipitated particles into larger particles that have more favorable (i.e., faster) settling characteristics.

The most difficult suspended solids to remove from process water are the colloids (e.g., silts, pin floc). Due to their very small size and electrostatic forces, colloidal solids tend to remain suspended for excessively long periods of time; detrimental to both filtration and sedimentation processes. Coagulation (i.e., charge neutralization) is essential to effective colloid removal. Once the charge is reduced or eliminated, then repulsive forces are minimized and gentle agitation in a contact vessel can cause the colloidal solids to collide and form micro-flocs that continue to grow into visible floc particles that settle rapidly and filter easily.

The bench-scale testing is used to determine approximate process operating parameters and characteristics, for example; appropriate chemical reagent and dosage, optimum pH, reaction retention time, treatment volumes/ratios, temperature, mixing requirements, coagulant & flocculent selection, suspended solids, and sludge volume and characteristics.

Each site and project will have unique characteristics that will dictate the conceptual test planning and procedures. However, there are general guidelines and procedures that will enable good data collection and record keeping. **The first and most important guideline is good and comprehensive record-keeping. Write it down and make sure that it is clear for later referral.**

Testing Procedures

Bench-scale testing procedures will vary according to the site specific conditions and available samples. However, comprehensive advance planning including identification of the testing objectives and required testing equipment will enable the most useful testing results.

Below is an example procedure for evaluation of a coagulant and flocculent. The exact procedure should be pre-determined in a planning session that targets project specific objectives.

Examples of Some Important Bench-scale Testing Parameters:

- Initial solution pH
- Temperature
- Alkalinity
- Approximate amount of settleable, suspended/colloidal, dissolved solids
- Hazardous characteristics
- Neutralization chemicals characteristics and amount used to neutralize to a particular pH.

. Example Testing Equipment

- pH meter with electrode to monitor pH (if available).
- **ADEGA Liter Containers**
- Eyedroppers & chemical syringes for adding chemical reagents.
- Filter paper and cone
- Turbidity meter (if available)
- Metals Test Kit or Spectrophotometer (if available).
- Timing device (e.g., stop watch, or equal)

Chemicals:

1. Sodium-Hydroxide (Caustic-Soda) solution for pH adjustment (if needed)
2. Sulfuric-Acid solution for pH adjustment (if needed)
3. ADEGA Coagulants & Flocculants

pH considerations

Generally, coagulation and flocculation is performed successfully over a relatively wide range of water pH. Typically, optimum results are achieved within a pH range of 5 to 10. On project sites, pH adjustment is sometimes required to achieve water pH within a target discharge compliance range. It is recommended that pH adjustment be performed prior to coagulation and flocculation testing.

ADEGA Coagulation/Flocculation Test Kit

ADEGA has developed a convenient and “easy-testing” kit for the purpose of on-site bench-scale testing. The testing kit is comprised of small plastic containers (approximately 1.5 liters) with lids that may be used for making 1 liter wastewater samples to perform coagulation, and flocculation bench-scale testing.

When using the easy-testing containers; you can stir the contents within the container or you can place the lid on the container and shake/stir/swirl the container and liquid contents within the container by hand. Shake/swirling should be performed to achieve the same objective as if you were stirring a mixture using a Jar Test mixing device:

- Fast Mix – using the easy-testing container should be considered vigorously swirled for up to a minute or even two. You are looking for signs that the chemical has been thoroughly mixed into the water. When fast mix is completed, let the container sit undisturbed for up to 5 minutes to observe the conditions:
 - If testing coagulation – see if signs of charge neutralization and settling and flocs are developing
- Slow Mix - using the easy-testing container should be considered less-vigorous swirling for up to a minute or even two. You are looking for signs that the chemical has been thoroughly mixed into the water and that larger flocs may be developing as the chemical is thoroughly mixed into the water. When slow mix is completed, let the container sit undisturbed for up to 5 minutes to observe the conditions:
 - If testing flocculation – see if larger flocs that may settle more quickly develop.

Coagulation/Flocculation Testing Procedure:

1. Take time to consider the testing objectives and plan the testing out in stages that will allow you to make reasonable and accurate conclusions. Do not try too many things at once as this strategy may inhibit your ability to establish reliable test results and draw accurate conclusions.
2. Measure the initial chemical/physical characteristics of the sample
3. Record chemical/physical observations regarding the sample
4. Pour a sample of untreated wastewater into a containers or group of containers (e.g., 1,000 ml size containers).
5. To the sample container(s) - add a prescribed (planned) amount of coagulant to the sample – amount depends on the target concentration. For example – a 50 % PAC product may only require 1 ml of product injected into a 1,000 mL sample to achieve a PAC concentration of greater than 500 mg/L in the sample. Typical coagulant doses vary with the amount of target metal to be removed from solution.
 - High initial solids concentrations will require less coagulant dose to aid the process.
 - Testing more than one sample concentration (at the same time) is a good way to compare results against each other – for example: in the 1st container you might add approximately 25 mg/L; in a 2nd container add 50 mg/L; 3rd container add 75 mg/L; 4th container add 100 mg/L – another example; in the 1st container you might add approximately 100 mg/L; in a 2nd container add 200 mg/L; 3rd

container add 400 mg/L; 4th container add 600 mg/L. It is your choice to help you focus in on the best dose for the specific application.

- In coagulation more is not always better.
 - After evaluating the first set of results, one would typically test various concentrations closer to the best results from the first set. For example; let's say that the jar test results in the range of 100 to 200 mg/L appeared to show better results than other ranges. Then you might try another set; in the 1st container you might add approximately 100 mg/L; in a 2nd container add 125 mg/L; 3rd container add 150 mg/L; 4th container add 200 mg/L. The idea is to narrow down your range of concentrations to select a desired treatment dosage.
 - Various concentrations can be as narrow a range or as wide a range as desired.
 - i. Could be a preliminary range to get an idea of what is working - like 100 mg/L, 200 mg/L, 300 mg/L, 400 mg/L.
 - ii. Could be a tight range to determine exactly what dose you want to use – like 1mg/L, 2 mg/L, 3 mg/L, 4 mg/L
 - The range of concentrations depends on the treatment application:
 - i. WC-500 coagulant typical dosage requirements can range from as little as 10 to 20 mg/L to greater than 100 to 300 mg/L.
 - ii. Organic Polymer Coagulants (cationic) typical dosage requirements can range from as little as 5 to 10 to 20 mg/L (for coagulation aid) to 50 to 100 mg/L (for sludge dewatering).
 - iii. Organic Polymer Flocculants (non-ionic & anionic) typical dosage requirements can range from 1 to 5 mg/L sometimes as high as 10 mg/L to 15 mg/L – you do not typically want to use more than a 3 to 5 mg/L of anionic polymer because it may adversely affect sludge conditioning and filter press performance.
6. Perform Fast Mix using the ADEGA liter containers for 1 to 2 minutes and observe the subsequent coagulation of the precipitated particles. Do they appear to be separating and/or creating larger flocs over time? If the particles appear to be coagulating but are perhaps very slowly settling, a flocculent may be beneficial to the process.
- Do not look at an experiment as being a success or failure – we need to look at this as being a test that informs you of how things are working. When something does not work; that can be just as informative (by showing what is not working) as when something is working.
 - Completed results will enable you to plan what your next move will be in terms of developing a process.
 - It is important to write down the results that you find so that you will be able to evaluate later and be able to make intelligent decisions based on the testing results that you have already completed.
7. If being evaluated, flocculent should be added to the solution followed by a Slow Mixing procedure for 2 to 3 minutes to allow for chemical contact to take place and floc building. Flocculent doses may vary but tend to be in a range of 1 to 5 mg/L (active). Higher doses of flocculent may be a bad sign for subsequent solids handling (e.g., sludge thickening, filter press operation).

- It is very important to make sure that you actually get the flocculant well mixed into the sample solution. Do not be shy about swirling the sample vigorously enough to get the mix.
 - Just as important – after mixing, you need to allow the flocculant some time to affect the precipitated solids and develop larger flocs that will settle out of solution and create a clearer supernatant above the settled solids. The flocs will typically develop into large flocs within a few minutes.
8. If the settling action is too slow or incomplete, it may indicate a greater concentration of coagulant/flocculent needed. Performing several sample tests concurrently with varying levels of coagulant or flocculent may enable evaluation of optimum coagulant/flocculent concentration. Be careful to vary one chemical at a time – when evaluating the relative performance of various doses of a coagulant – apply the same flocculent dose to all the samples – only vary the coagulant. The same rule applies when evaluating varying doses of flocculants.
 9. After a prescribed settling time period (5 to 15 minutes); a clear supernatant should be visible in the upper portion of the sample container. This supernatant may be collected for analytical evaluation. The collected sample should be filtered to remove specs and the filtered sample then analyzed.

1 drop = 0.05 ml

1 drop per liter = 50 mg/l (ppm)

Be sure to take time to observe results and record your testing results; including data like time for settling, visual observations, chemical doses amounts, pH, etc. for the purpose of later data review and system design.

APPENDIX B
TREATABILITY STUDIES

Date: December 18, 2015

Customer: Mr. Ron DiFrancesco
Associate and Senior Consultant
Golder Associates, Inc.
2108 W. Laburnum Ave., Suite 200
Richmond, Virginia 23277

Project Location: Bremono Bluff, VA

Project Scope: Treatability Study for Dominion's East Ash Pond

GWTT Ref#: 6410

Dear Mr. DiFrancesco:

Ground/Water Treatment & Technology, LLC (GWTT) is pleased to submit this report which has been prepared to detail the findings of a laboratory study in accordance with our proposal dated September 8, 2015.

Please find as follows:

Summary

Approximately 20 gallons of water from the Bremono East Ash Pond were collected on November 23, 2015 and received in the laboratory on November 25, 2015. The water represents what is called pore water from the East Ash Pond.

The purpose of this testing is to determine the effectiveness of chemical precipitation in treating the water to discharge standards laid out in the Virginia Department of Environmental Quality draft permit. The treatability process was performed to determine the degree of metals reduction through GWTT's chemical precipitation pre-treatment system.

When designing a treatment process it is required that the discharge standards are known. In this case they are yet to be finalized for this particular site. The discharge criteria in the draft permit are included in Table 1 containing the sampling results from the treatability study.

The sample received had a significant quantity of very fine particles that had settled at the bottom of the containers. Each of the containers was not mixed to simulate a well point system. The solids were black in color.

Samples Collected

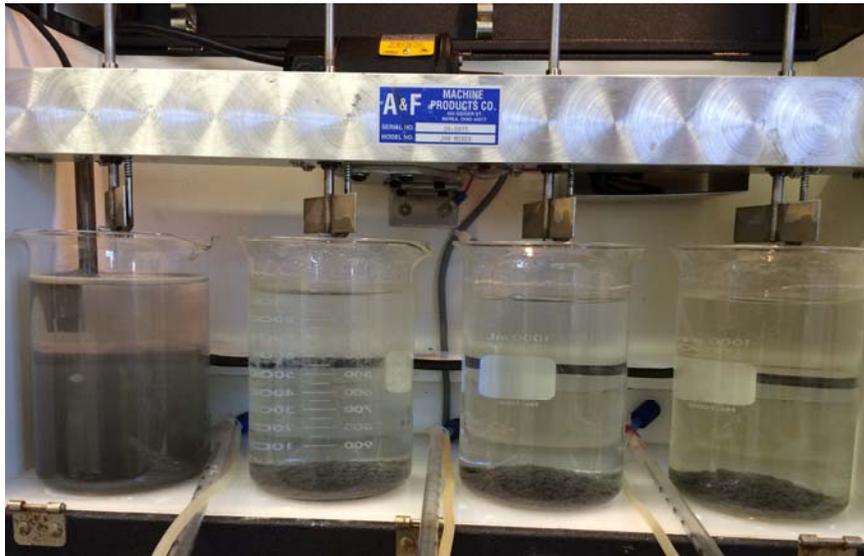
The following samples were collected and analyzed during the treatability study:

1. Untreated water (INFLUENT)
2. Chemically precipitated effluent passed through a 5-micron (um) filter (CHEM PRECIP)
3. Chemically precipitated effluent passed through a 0.5-um cartridge filter (FILTRATION)
4. Ion exchange resin treated water (TREATED)

Five gallons split from the total volume of the sample (20 gallons) were mixed completely for the treatability testing process. A split sample for analyses was prepared for the laboratory, labelled INFLUENT. The untreated water was then aerated for 15 minutes to reduce the amount of dissolved metals in the waste stream. Following the aeration step, the pH of the aerated sample was increased to approximately 9.5 standard units (s.u.) using sodium hydroxide to decrease the solubility of the metals in the waste stream. After the pH was adjusted, a coagulant and a flocculent were added to begin the chemical precipitation process. After the precipitation chemicals were added and allowed to completely mix, the samples were allowed to settle for 10 minutes to simulate clarification.

The decanted effluent water was passed through a 5-um filter and a split sample was collected and analyzed by the laboratory, labelled CHEM PRECIP. The filtered sample was filtered again through a 0.5-um filter to determine the amount of dissolved metals remaining in the sample. A split sample of the sub-micron filtered water was collected for analysis by the laboratory, labelled FILTRATION.

Water that was filtered through a 0.5-um cartridge filter was collected for the next unit operation to reduce the dissolved metals concentrations that remain from the chemical precipitation process. Ion exchange resin was placed into vessels to simulate the required empty bed contact time (EBCT) of the full scale treatment plant. Two types of resins were tested in series; the first resin was a cationic resin to reduce metals such as copper, nickel, lead and zinc, followed by an anionic resin that will reduce metals such as arsenic, selenium and thallium. The filtered sample was pumped through both resin beds, and a sample was collected and analyzed by the laboratory, labelled TREATED.



Beaker 1

- Untreated
- Solids Settling

Beakers 2,3 and 4

- Aerated for 15 minutes
- pH adjustment with hydroxide to pH of approximately 9.5
- Varying Coagulation Dosages
- Varying Flocculation Dosages
- Solids Settling

Treatability Results

The results of the analytical testing, along with the draft permit discharge limits for Bremo, are presented in Table 1. The untreated East Ash Pond sample had elevated levels of copper, lead and total suspended solids when compared to the limits in the draft permit, as shown by the highlighted yellow values. The nickel concentration is close the permitted discharge limit, and may be a contaminant of concern if the concentration increases slightly.

The untreated influent sample of East Ash Pond pore water from the previous treatability testing performed in July 2015 was also compared to the draft permit limits for Bremo. The untreated pore water sample from July 2015 had elevated levels of copper, lead, nickel and total suspended solids when compared to the proposed limits for Bremo in the draft permit, as shown by the highlighted yellow values presented in Table 1.

It should be noted that there was an elevated concentration of arsenic in the untreated East Ash Pond sample when compared to the concentration in the previous East Ash Pond pore water sample, but neither of these values were above the draft Bremono permit limit for arsenic.

A subsample of the East Ash Pond untreated influent was later analyzed for dissolved metals in order to determine if the metals concentrations were dissolved in the wastewater or could be attributed to the elevated total suspended solids in the sample. This step was performed to mimic the mechanical filtration that is currently on-site using bag and cartridge filters. The results are shown in Table 2. A majority of the metals of concern in the treatability testing were reduced to below permit limits through mechanical filtration. A notable exception is that the concentration of selenium in the filtered sample was higher than the draft permit limit.

The treatability study results indicate that the treatment process including aeration, hydroxide precipitation, followed by coagulation/flocculation/settling will reduce the contaminants of concern to below the Bremono discharge limits described in the draft permit.

We trust this report is fully responsive to your request. If you have any questions regarding this matter please contact me.

Best Regards,



Rob Orlando
Chief Engineer

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Cell (973) 800 3531



Beyond Water Treatment

Table 1
Laboratory Bench Test Results - BreMO East Pond

PARAMETER	TREATABILITY TESTING RESULTS																
	EAST POND PZ-2 070115		EAST POND PZ-2 112315								BREMO PERMIT LIMITS						
	INFLUENT	Q	INFLUENT	Q	MDL	CHEM PRECIP	Q	MDL	FILTRATION	Q	MDL	TREATED	Q	MDL	MINIMUM	MONTHLY AVERAGE	DAILY MAXIMUM
<i>Total Metals (mg/L)</i>																	
Antimony	0.007		ND		0.008	ND		0.008	ND		0.008	ND		0.008	NL	2.1	2.1
Arsenic	0.061		0.121		0.002	0.027		0.002	0.027		0.002	ND		0.002	NL	0.29	0.53
Cadmium	0.00072	U	ND		0.001	ND		0.001	ND		0.001	ND		0.001	NL	0.0018	0.0032
Chromium	0.02		0.02		0.002	ND		0.002	0.003	J	0.002	0.002		0.002	NL	0.12	0.22
Copper	0.051		0.055		0.002	0.004	J	0.002	0.004	J	0.002	0.005		0.002	NL	0.012	0.023
Lead	0.026		0.026		0.002	0.002	J	0.002	ND		0.002	ND		0.002	NL	0.019	0.035
Mercury	0.00014	U	0.00009	J	0.00006	ND		0.00006	ND		0.00006	ND		0.00006	NL	0.0015	0.0028
Nickel	0.046		0.029		0.004	ND		0.004	ND		0.004	ND		0.004	NL	0.031	0.057
Selenium	0.0037	J	0.005	J	0.003	0.005	J	0.003	ND		0.003	ND		0.003	NL	0.0096	0.018
Silver	--		ND		0.002	ND		0.002	ND		0.002	ND		0.002	NL	0.0027	0.005
Thallium	--		ND		0.004	ND		0.004	ND		0.004	ND		0.004	NL	0.0014	0.0014
Zinc	0.034		0.036	J	0.007	ND		0.007	0.023	J	0.007	0.013	J	0.007	NL	0.11	0.21
<i>General Chemistry (mg/L)</i>																	
Total Suspended Solids	24600		790		NA	ND		NA	ND		NA	ND		NA	NL	30	100
Oil and Grease, Hem-Grav	2.8	U	ND			--			--			ND			NL	15	20
TPH, SGT-HEM	2.8	U	ND			--			--			ND			NL	NL	NL
Hexavalent Chromium	0.0049	U	ND		0.003	ND		0.003	ND		0.003	ND		0.003	NL	0.018	0.034
Ammonia-N	0.08	J	--			--			--			--			NL	9.6	14
Hardness (as CaCO ₃)	--		--			--			--			--			NL	MONITOR	MONITOR
Ph (standard units)	8.03		7.927			--			--			--			6.0	NL	9.0
<i>Anions (mg/L)</i>																	
Chloride	10.6		3.02		0.054	18.7		0.054	22.1		0.054	198		0.054	NL	450	820
Sulfate	--		45.6		0.051	44.8		0.051	46.3		0.051	0.352	J	0.051	NL	NL	NL
<i>Acute Whole Effluent Toxicity (%)</i>																	
Ceriodaphnia Dubia	--		--			--			--			--			100	NL	NL
Pimephales promelas	--		--			--			--			--			100	NL	NL
<i>Chronic Whole Effluent Toxicity (TU_c)</i>																	
Ceriodaphnia Dubia	--		--			--			--			--			NL	NL	6.25
Pimephales promelas	--		--			--			--			--			NL	NL	6.25
NOTES																	
ND - Non Detect																	
Q - Qualifier																	
J - Estimated Concentration																	
U - Undetected																	
NL - No Limit																	
Highlighted Limits indicate that the untreated concentration is greater than effluent discharge limit for the specified constituent																	

Table 2
Laboratory Bench Test Results - BreMO East Pond Dissolved Metals

PARAMETER	EAST POND PZ-2 112315			BREMO		
	INFLUENT	Q	MDL	MINIMUM	AVERAGE	MAXIMUM
	<i>Dissolved Metals (mg/L)</i>					
Antimony	0.102		0.008	NL	2.1	2.1
Arsenic	0.068		0.002	NL	0.29	0.53
Cadmium	ND		0.001	NL	0.0018	0.0032
Chromium	0.002	J	0.002	NL	0.12	0.22
Copper	0.004	J	0.002	NL	0.012	0.023
Lead	ND		0.002	NL	0.019	0.035
Mercury	--			NL	0.0015	0.0028
Nickel	0.004	J	0.004	NL	0.031	0.057
Selenium	0.011		0.003	NL	0.0096	0.018
Silver	ND		0.002	NL	0.0027	0.005
Thallium	ND		0.004	NL	0.0014	0.0014
Zinc	ND		0.007	NL	0.11	0.21
NOTES						
ND - Non Detect						
Q - Qualifier						
J - Estimated Concentration						
NL - No Limit						
Highlighted Limits indicate that the untreated concentration is greater than effluent discharge limit for the specified constituent						

Date: January 6, 2016

Customer: Mr. Ron DiFrancesco
Associate and Senior Consultant
Golder Associates, Inc.
2108 W. Laburnum Ave., Suite 200
Richmond, Virginia 23277

Project Location: Bremono Bluff, VA

Project Scope: Second Round of Treatability Study for Dominion's East Pond (On-site)

GWTT Ref#: 6410

Dear Mr. DiFrancesco:

Ground/Water Treatment & Technology, LLC (GWTT) is pleased to submit this report which has been prepared to detail the findings of an on-site laboratory scale study in accordance with our proposal dated September 8, 2015.

Please find as follows:

Summary

Approximately 5 gallons of water from the Bremono East Ash Pond were collected from Piezometer PZ-2 on December 27, 2015 by Golder and tested on-site by GWTT. The water represents what is called pore water from the East Ash Pond.

The purpose of this testing is to determine the effectiveness of chemical precipitation in treating the water to discharge standards laid out in the Virginia Department of Environmental Quality draft permit. The treatability process was performed to determine the degree of metals reduction through GWTT's chemical precipitation pre-treatment system.

When designing a treatment process, it is required that the discharge standards are known. In this case, the discharge limits are determined by the Virginia Department of Environmental Quality through

the draft permit being issued to Dominion. The discharge criteria included in Table 1 contain the sampling results from the treatability study as compared to the draft permit received from Golder on January 5, 2016.

The sample collected had a significant quantity of very fine grey suspended particles that were evident throughout the treatability testing. The sample had a pH of 7.3 standard units (s.u.). This sample had a different color than the samples received in Wharton, NJ by GWTT during the first treatability study (in the laboratory), which were black due to oxidation/mixing of the samples during transit.

Samples Collected

The following samples were collected and analyzed during the treatability study:

1. Untreated water (PZ2 INF)
2. Chemically precipitated effluent passed through a 5-micron (μm) filter (PZ2 EFF)
3. Aerated effluent not filtered through a 5- μm filter (PZ2 Mid 1)
4. Aerated and pH adjusted effluent not filtered through a 5- μm filter (PZ2 Mid 2)

Five gallons collected from PZ2 were mixed completely for the treatability testing process. A split sample for analyses was prepared for the laboratory, labelled PZ2 INF. The remaining water was collected and set up in the treatability testing mobile laboratory.



The untreated water was aerated for 15 minutes to reduce the amount of dissolved metals in the waste stream. Following the aeration step, the pH of the aerated sample was increased to approximately 9.5 s.u. using sodium hydroxide to decrease the solubility of the metals in the waste stream. After the pH was adjusted, a coagulant and a flocculent were added to begin the chemical precipitation process. After the precipitation chemicals were added and allowed to completely mix, the samples were allowed to settle for 10 minutes to simulate clarification.



The decanted effluent water was passed through a 5-um filter, and a split sample was collected and analyzed by the laboratory, labelled PZ2 EFF. Each of the four sample jars tested had similar chemical additions from the previous testing, and were retested to determine the efficiency with the different water collected during this treatability test.

Beakers 1, 2, 3 and 4

- Aerated for 15 minutes
- pH adjustment with hydroxide to pH of approximately 9.5
- Single Coagulation Dosage (0.05 mL/L Water)
- Single Flocculation Dosage (1.0 mL/L Water)
- Solids Settling



A second treatability test was performed to determine the efficiency of total metals reduction at each step of the metals pre-treatment process. The sample from PZ-2 was aerated for 15 minutes and was collected for total metals analysis by the laboratory, labelled PZ2 Mid1. The sample was not filtered prior to collection, and the pH of the sample rose to 8.6 s.u.

The next process added sodium hydroxide to the aerated water to increase the pH to a value of 9.5 s.u., and the water was allowed to equalize prior to sample collection. The unfiltered sample was collected and analyzed by the laboratory, labelled PZ2 Mid2. The final pH of the sample was 9.6 s.u.

Treatability Results

The results of the analytical testing, along with the draft permit discharge limits for Bremo, are presented in Table 1 and Table 2. The untreated East Ash Pond sample had elevated levels of arsenic, cadmium, chromium (III), copper, lead, nickel, selenium, thallium, zinc and total suspended solids

when compared to the limits contained in the draft permit. The pre-treatment process reduced the elevated constituents to below the draft permitted limits, with the exception of pH, as shown in Table 1. Therefore, an additional pH adjustment step will be implemented prior to discharge, to meet the pH effluent limit.

The untreated influent sample of East Ash Pond pore water was also tested after each pre-treatment step to determine the extent of reduction of each process.

The aerated pore water sample had elevated levels of copper, lead, nickel, selenium, thallium and total suspended solids (based upon the turbidity measurement of the effluent sample) when compared to the proposed limits in the draft permit, as shown in Table 2. The sample was not filtered prior to total metals analysis.

The aerated pore water sample that was pH adjusted had elevated levels of copper, lead, nickel, selenium, thallium and total suspended solids (based upon the turbidity measurement of the effluent sample) when compared to the proposed limits in the draft permit, as shown in Table 2. The sample was not filtered prior to total metals analysis.

The treatability study results indicate that the treatment process including aeration, hydroxide precipitation, followed by coagulation/flocculation/settling will reduce the contaminants of concern to below the Bremo discharge limits described in the draft permit. These unit operations will need to be operated in conjunction with one another in order to reduce the contaminants to below the permitted discharge limits.

We trust this report is fully responsive to your request. If you have any questions regarding this matter please contact me.

Best Regards,



Rob Orlando

Chief Engineer

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Beyond Water Treatment

TABLE 1: Treatability Testing Results

Analyte	Method	Date	Units	Detection Limit	Reporting Limit	Final Draft Permit MA	Final Draft Permit DM	P22(INF)	P22(EFF)
								Results	Results
pH (Minimum and Maximum)	Field	12/28/2015	S.U.	0.1	0.1	6.0	9.0	7.3	9.3
Oil and Grease	HEM	12/28/2015	mg/L	1.1	5.0	15	20	ND	ND
Antimony	200.7	12/28/2015	ug/L	3.9	5.0	2,100	2,100	11.1	9.0
Arsenic	200.7	12/28/2015	ug/L	5.0	10.0	290	530	328	25.7
Cadmium	200.7	12/28/2015	ug/L	0.50	1.0	1.8	3.2	2.4	ND
Chromium, total	200.7	12/28/2015	ug/L	2.5	5.0	No Limit	No Limit	119	ND
Chromium, trivalent	calculated	12/28/2015	ug/L	NA	NA	120	220	119	ND
Chromium, Hexavalent	SM-3500-Cr-B	12/28/2015	ug/L	0.005	0.010	18	34	ND	ND
Copper	200.8	12/28/2015	ug/L	2.5	5.0	12	23	227	0.6
Lead	200.7	12/28/2015	ug/L	2.5	5.0	19	35	103	ND
Mercury	245.1	12/28/2015	ug/L	0.070	0.20	1.5	2.8	1.2	ND
Nickel	200.7	12/28/2015	ug/L	2.5	5.0	31	57	170	6.4
Selenium	200.7	12/28/2015	ug/L	5.0	10.0	9.6	18	45.8	ND
Silver	200.8	12/28/2015	ug/L	0.050	0.10	2.7	5.0	0.31	ND
Thallium	200.8	12/28/2015	ug/L	0.50	1.0	1.4	1.4	2.6	0.56
Zinc	200.7	12/28/2015	ug/L	2.5	10.0	110	210	137	9.3
Hardness as CaCO3	SM-2340B	12/28/2015	ug/L	662	662	No Limit	No Limit	336,000	240,000
Turbidity	180.1	12/28/2015	NTU	0.50	1.0	No Limit	No Limit	over range	6.51
Total Suspended Solids	SM-2540D	12/28/2015	mg/L	13.3*	13.3*	30.0	100	1,940	ND
Ammonia - N	350.1	12/28/2015	mg/L	0.0050	0.010	9.6	14	0.15	0.20
Chloride	SM-4500-CL-E	12/28/2015	mg/L	0.50	1.0	450	820	3.4	13.3
Cyanide	SM-4500-CN-E	12/28/2015	mg/L	0.004	0.008	No Limit	No Limit	ND	ND

Notes:
 ug/L = micrograms per liter mg/L = milligrams per liter SU = Standard Units "--" = No Data
 ND = Not Detected at the indicated detection limit MA = Monthly Average DM = Daily Maximum
 Result exceeds Final Draft Permit MA and/or DM limit
 Result is qualified with "J" as an estimated concentration above the Detection Limit and below the Reporting Limit
 * DL and RL are being verified by Pace

TABLE 2: Treatability Testing Midpoint Results

Analyte	Method	Date	Units	Detection Limit	Reporting Limit	Final Draft Permit MA	Final Draft Permit DM	PZ2(Mid1)	PZ2(Mid2)
								Results	Results
pH (Minimum and Maximum)	Field	12/28/2015	S.U.	0.1	0.1	6.0	9.0	8.6	9.6
Oil and Grease	HEM	12/28/2015	mg/L	1.1	5.0	15	20	--	--
Antimony	200.7	12/28/2015	ug/L	3.9	5.0	2,100	2,100	12.6	10.5
Arsenic	200.7	12/28/2015	ug/L	5.0	10.0	290	530	200	178
Cadmium	200.7	12/28/2015	ug/L	0.50	1.0	1.8	3.2	1.2	1.0
Chromium, total	200.7	12/28/2015	ug/L	2.5	5.0	No Limit	No Limit	46.2	54.0
Chromium, trivalent	calculated	12/28/2015	ug/L	NA	NA	120	220	46.2	54.0
Chromium, Hexavalent	SM-3500-Cr-B	12/28/2015	ug/L	0.005	0.010	18	34	ND	ND
Copper	200.8	12/28/2015	ug/L	2.5	5.0	12	23	67.6	82.4
Lead	200.7	12/28/2015	ug/L	2.5	5.0	19	35	35.1	40.9
Mercury	245.1	12/28/2015	ug/L	0.070	0.20	1.5	2.8	0.45	0.40
Nickel	200.7	12/28/2015	ug/L	2.5	5.0	31	57	64.7	74.8
Selenium	200.7	12/28/2015	ug/L	5.0	10.0	9.6	18	10.8	15.3
Silver	200.8	12/28/2015	ug/L	0.050	0.10	2.7	5.0	0.076	0.14
Thallium	200.8	12/28/2015	ug/L	0.50	1.0	1.4	1.4	2.2	1.8
Zinc	200.7	12/28/2015	ug/L	2.5	10.0	110	210	56.8	67.9
Hardness as CaCO3	SM-2340B	12/28/2015	ug/L	662	662	No Limit	No Limit	319,000	309,000
Turbidity	180.1	12/28/2015	NTU	0.50	1.0	No Limit	No Limit	over range	over range
Total Suspended Solids	SM-2540D	12/28/2015	mg/L	13.3*	13.3*	30.0	100	--	--
Ammonia - N	350.1	12/28/2015	mg/L	0.0050	0.010	9.6	14	--	--
Chloride	SM-4500-CL-E	12/28/2015	mg/L	0.50	1.0	450	820	--	--
Cyanide	SM-4500-CN-E	12/28/2015	mg/L	0.004	0.008	No Limit	No Limit	--	--

Notes:
 ug/L = micrograms per liter mg/L = milligrams per liter SU = Standard Units "--" = No Data
 ND = Not Detected at the indicated detection limit MA = Monthly Average DM = Daily Maximum
 Result exceeds Final Draft Permit MA and/or DM limit
 Result is qualified with "J" as an estimated concentration above the Detection Limit and below the Reporting Limit
 * DL and RL are being verified by Pace

Aeration Calculations

Design Recommendations for Aeration

Minimum Time
10 min

Design Time
15 min

Full Scale Volume (Frac Tank)

18,000 gallons

Working Volume (Frac Tank)

15,000 gallons

Hydraulic Residence Time (HRT)

Design Flow Rate (500 GPM)

$$\frac{15,000 \text{ gallons}}{500 \text{ gallons/minute}} = 30 \text{ min}$$

Maximum Flow Rate (1,500 GPM)

$$\frac{15,000 \text{ gallons}}{1,500 \text{ gallons/minute}} = 10 \text{ min}$$

Bench Scale Air Flow Rate (scfm)

0.0075 scfm

Dosage at Aeration Time

0.075 ft³

0.113 ft³

Full Scale Aeration Blower

500 scfm

@

100 " H₂O

NOTES:

1 ft³ = 7.48 gallons

60 min/hr

GPM - gallons per minute

scfm - standard cubic feet per minute

pH Adjustment Calculations

Influent pH (Bench Scale Testing) 7.3 s.u.

Flow Rate (GPM)

Design Flow	Maximum Flow
500 GPM	1,500 GPM

Chemical Used for pH Adjustment 25% NaOH

From Bench Scale Testing **0.155** $\frac{\text{mL NaOH}}{\text{L H}_2\text{O}}$ to raise pH to 9.5 s.u.

$$\text{Full Scale Flow Rate (Design Flow)} \quad \frac{0.155 \text{ mL NaOH}}{\text{L H}_2\text{O}} \times \frac{3.785 \text{ L H}_2\text{O}}{\text{gal H}_2\text{O}} \times \frac{500 \text{ gallons}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}} \times \frac{\text{gal NaOH}}{3,785 \text{ mL NaOH}} = \frac{4.7 \text{ gal NaOH}}{\text{hour}}$$

$$\text{Full Scale Mass Loading (Design Flow)} \quad \frac{4.65 \text{ gal NaOH}}{\text{hour}} \times \frac{10.7 \text{ lbs NaOH}}{\text{gal NaOH}} = \frac{49.755 \text{ lbs NaOH}}{\text{hour}}$$

$$\text{Full Scale Flow Rate (Maximum Flow)} \quad \frac{0.155 \text{ mL NaOH}}{\text{L H}_2\text{O}} \times \frac{3.785 \text{ L H}_2\text{O}}{\text{gal H}_2\text{O}} \times \frac{1,500 \text{ gallons}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}} \times \frac{\text{gal NaOH}}{3,785 \text{ mL NaOH}} = \frac{14 \text{ gal NaOH}}{\text{hour}}$$

$$\text{Full Scale Mass Loading (Maximum Flow)} \quad \frac{13.95 \text{ gal NaOH}}{\text{hour}} \times \frac{10.7 \text{ lbs NaOH}}{\text{gal NaOH}} = \frac{149.27 \text{ lbs NaOH}}{\text{hour}}$$

Hydraulic Residence Time (HRT)

$$\text{Design Flow Rate (500 GPM)} \quad \frac{15,000 \text{ gallons}}{500 \text{ gallons/minute}} = 30 \text{ min}$$

$$\text{Maximum Flow Rate (1,500 GPM)} \quad \frac{15,000 \text{ gallons}}{1,500 \text{ gallons/minute}} = 10 \text{ min}$$

NOTES:

1 ft³ = 7.48 gallons

60 min/hr

3,785 mL/gallon

GPM - gallons per minute

Coagulation Calculations

Coagulant

WC-500 (polyaluminum chloride)

Flow Rate (GPM)

Design Flow		Maximum Flow	
500	GPM	1,500	GPM

From Bench Scale Testing

$$\frac{0.050 \text{ mL WC-500}}{\text{L H}_2\text{O}}$$

Full Scale Flow Rate (Design Flow)

$$\frac{0.050 \text{ mL WC-500}}{\text{L H}_2\text{O}} \times \frac{3.785 \text{ L H}_2\text{O}}{\text{gal H}_2\text{O}} \times \frac{500 \text{ gallons}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}} \times \frac{\text{gal WC-500}}{3,785 \text{ mL WC-500}} = \frac{1.5 \text{ gal WC-500}}{\text{hour}}$$

Full Scale Mass Loading (Design Flow)

$$\frac{1.5 \text{ gal WC-500}}{\text{hour}} \times \frac{11.18 \text{ lbs WC-500}}{\text{gal WC-500}} = \frac{16.8 \text{ lbs WC-500}}{\text{hour}}$$

Full Scale Flow Rate (Maximum Flow)

$$\frac{0.050 \text{ mL WC-500}}{\text{L H}_2\text{O}} \times \frac{3.785 \text{ L H}_2\text{O}}{\text{gal H}_2\text{O}} \times \frac{1,500 \text{ gallons}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}} \times \frac{\text{gal WC-500}}{3,785 \text{ mL WC-500}} = \frac{4.5 \text{ gal WC-500}}{\text{hour}}$$

Full Scale Mass Loading (Maximum Flow)

$$\frac{4.5 \text{ gal WC-500}}{\text{hour}} \times \frac{11.18 \text{ lbs WC-500}}{\text{gal WC-500}} = \frac{50.3 \text{ lbs WC-500}}{\text{hour}}$$

NOTES:

1 ft³ = 7.48 gallons

60 min/hr

3,785 mL/gallon

GPM - gallons per minute

Flocculation Calculations

Flocculant AP-210 (0.2% by Mass)

Flow Rate (GPM)

Design Flow		Maximum Flow	
500	GPM	1,500	GPM

From Bench Scale Testing

$$\frac{1.000 \text{ mL AP-210}}{\text{L H}_2\text{O}}$$

Full Scale Flow Rate (Design Flow)

$$\frac{1.000 \text{ mL AP-210}}{\text{L H}_2\text{O}} \times \frac{3.785 \text{ L H}_2\text{O}}{\text{gal H}_2\text{O}} \times \frac{500 \text{ gallons}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}} \times \frac{\text{gal AP-210}}{3,785 \text{ mL AP-210}} = \frac{30 \text{ gal AP-210}}{\text{hour}}$$

Full Scale Mass Loading (Design Flow)

$$\frac{30 \text{ gal AP-210}}{\text{hour}} \times \frac{8.34 \text{ lbs AP-210}}{\text{gal AP-210}} \times \frac{2 \text{ lbs AP-210 (ACTIVE)}}{1,000 \text{ lb AP-210}} = \frac{0.5 \text{ lbs AP-210}}{\text{hour}}$$

Full Scale Flow Rate (Maximum Flow)

$$\frac{1.000 \text{ mL AP-210}}{\text{L H}_2\text{O}} \times \frac{3.785 \text{ L H}_2\text{O}}{\text{gal H}_2\text{O}} \times \frac{1,500 \text{ gallons}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}} \times \frac{\text{gal AP-210}}{3,785 \text{ mL AP-210}} = \frac{90 \text{ gal AP-210}}{\text{hour}}$$

Full Scale Mass Loading (Maximum Flow)

$$\frac{90 \text{ gal AP-210}}{\text{hour}} \times \frac{8.34 \text{ lbs AP-210}}{\text{gal AP-210}} \times \frac{2 \text{ lbs AP-210 (ACTIVE)}}{1,000 \text{ lb AP-210}} = \frac{1.5 \text{ lbs AP-210}}{\text{hour}}$$

NOTES:

1 ft³ = 7.48 gallons

60 min/hr

3,785 mL/gallon

GPM - gallons per minute

Full-Scale Media Treatment Specifications:

Media: CGS, 50 lb/ft³

Media Vessel: Siemens, Model PV-10000

V_D, Media Fill Volume = 330 ft³

Q_D, Design Flow Rate = 500 gal/min

$$\text{EBCT, Empty Bed Contact Time} = \frac{V_D}{Q_D/7.48} = 4.94 \text{ min} = 5 \text{ min}$$

Bench-Scale Media Treatment Specifications:

V_B, Media Fill Volume = 0.08722 ft³ = 0.087 ft³ 2" column diameter, 12 inch media fill height

X_B Media Weight = 4.36111 lbs

$$Q_B, \text{ Design Flow Rate} = \frac{V_B}{\text{EBCT}} \times 7.48 = \frac{0.087 \text{ ft}^3}{4.94 \text{ min}} \times 7.48 = 0.132 \text{ gal/min} = 7.9 \text{ gal/hr}$$

500 mL/min

Conversions:

1 ft³ = 7.48 gallons

60 min/hr

Full-Scale Media Treatment Specifications:

Media: SBG-1, 50 lb/ft³

Media Vessel: Siemens, Model PV-10000

V_D, Media Fill Volume = 330 ft³

Q_D, Design Flow Rate = 500 gal/min

$$\text{EBCT, Empty Bed Contact Time} = \frac{V_D}{Q_D/7.48} = 4.94 \text{ min} = 5 \text{ min}$$

Bench-Scale Media Treatment Specifications:

V_B, Media Fill Volume = 0.08722 ft³ = 0.087 ft³ 2" column diameter, 12 inch media fill height

X_B Media Weight = 4.36111 lbs

$$Q_B, \text{ Design Flow Rate} = \frac{V_B}{\text{EBCT}} \times 7.48 = 0.132 \frac{\text{gal}}{\text{min}} = 7.9 \frac{\text{gal}}{\text{hr}}$$

500 mL/min

Conversions:

1 ft³ = 7.48 gallons

60 min/hr

Date: February 29, 2016

Customer: Mr. Ron DiFrancesco
Associate and Senior Consultant
Golder Associates, Inc.
2108 W. Laburnum Ave., Suite 200
Richmond, Virginia 23277

Project Location: Bremono Bluff, VA

Project Scope: Treatability Study for Dominion's East Pond Spiked Sample

GWTT Ref#: 6410

Dear Mr. DiFrancesco:

Ground/Water Treatment & Technology, LLC (GWTT) is pleased to submit this report which has been prepared to detail the findings of an on-site laboratory scale study of elevated concentrations of metal.

Summary

Approximately 25 gallons of water from the Bremono East Ash Pond were collected from Piezometer PZ-2 by Golder and tested by GWTT at their treatability lab in Wharton, NJ. The water represents what is called pore water from the East Ash Pond.

The Centralized Treatment System currently installed at the Bremono site will successfully reduce all the metals (at the concentrations reported in the actual data) to below the discharge limits (VPDES Permit No. VA0004138, Dominion – Bremono Power Station). This is based upon previous treatability tests performed in both our lab and on-site, using East pond contact pore water.

However, it is understood that there is a concern for the need of a final polishing unit to address the potential for a *higher than normal level of metals* (Enhanced Metals Treatment Module) to protect the effluent discharge from a potential “metals spike” that may not be fully captured by the existing treatment system. In order to perform treatability testing for the

higher than normal level of metals, the East Pond pore water sample was “spiked” with a known concentration of total and dissolved metals to simulate this spike in metals in the Pore Water.

The purpose of this testing is to determine the effectiveness of the Enhanced Metals Treatment Module in treating the water to discharge standards laid out in the Virginia Department of Environmental Quality draft permit. The treatability process was performed to determine the degree of metals reduction through GWTT’s chemical precipitation pre-treatment system followed by the use of adsorptive media (fine grain limestone in conjunction with Activated Alumina).

When designing a treatment process, it is required that the discharge standards are known. In this case, the discharge limits are determined by the Virginia Department of Environmental Quality through the draft permit being issued to Dominion. The discharge criteria included in Table 1 contain the sampling results from the treatability study as compared to the draft permit received from Golder on February 19, 2016 through February 22, 2016.

The sample collected had a significant quantity of very fine grey/black suspended particles that were evident throughout the treatability testing. The sample had a pH of 7.3 standard units (s.u.).

Samples Collected

The following samples were collected and analyzed during the treatability study:

1. Untreated spiked wastewater (SPIKED)
2. Chemically precipitated effluent passed through a 0.5-micron (um) filter (FILTER PRECIP)
3. Three liters of chemically precipitate effluent passed through a fine grain limestone and activate alumina column (LIME 3L and AA 3L)
4. Six liters of chemically precipitate effluent passed through a fine grain limestone and activate alumina column (LIME 6L and AA 6L)
5. Twenty four liters of chemically precipitate effluent passed through a fine grain limestone and activate alumina column (LIME 24L and AA 24L)
6. Twenty nine liters of chemically precipitate effluent passed through a fine grain limestone and activate alumina column (LIME 29L and AA 29L)
7. Sixty seven liters of chemically precipitate effluent passed through a fine grain limestone and activate alumina column (LIME 67L and AA 67L)

Twenty-five gallons collected from PZ2 and the spiked metals solution were mixed completely for the treatability testing process. A split sample for analyses was prepared for the laboratory, labelled SPIKED, and analyzed for total and dissolved metals. The remaining water was collected and set up in the treatability laboratory.

The untreated water was treated with a chemical reducing agent (ferrous sulfate) and allowed to mix for 15 minutes to react with the soluble metals in the waste stream. The sample was aerated for 15 minutes to further reduce the amount of dissolved metals in the waste stream. Following the aeration step, the pH of the aerated sample was increased to approximately 9.0 s.u. using sodium hydroxide to decrease the solubility of the metals in the waste stream. After the pH was adjusted, a coagulant and a flocculent were added to begin the chemical precipitation process. After the precipitation chemicals were added and allowed to completely mix, the samples were allowed to settle for 10 minutes to simulate clarification.

Drum Composite Sample

- Ferrous Sulfate Dose (65 mL/L of a 0.0050% solution)
- Aerated for 15 minutes
- pH adjustment with hydroxide to pH of approximately 9.0
- Single Coagulation Dosage (0.05 mL/L Water)
- Single Flocculation Dosage (1.0 mL/L Water)
- Solids Settling



The decanted effluent water was passed through a 0.5-um filter, and a split sample was collected and analyzed by the laboratory, labelled FILTER PRECIP. Filtered effluent was then pumped through testing columns containing adsorptive media (fine grain limestone and activated alumina) at a rate of 30 mL/min. The testing columns contained 24" of adsorptive media per column with a column diameter of 1". Samples were collected from the effluent of each column at given volumes to determine the number of bed volumes pumped through the column:

Volume pumped through Column (L)	Bed Volumes
3 Liters	10
6 Liters	20
24 Liters	78
29 Liters	95
67 Liters	218

Treatability Results

The results of the analytical testing, along with the draft permit discharge limits for Bremono, are presented in Table 1. The untreated spiked East Ash Pond sample had elevated levels of arsenic, cadmium, chromium (III), copper, lead, nickel, selenium, thallium and zinc. The pre-treatment process reduced the elevated constituents to below the draft permitted limits, with the exception of selenium and thallium, as shown in Table 1. The untreated spiked sample contained two times the historical concentration of dissolved selenium and thallium when compared to the historical data.

The effluent of the pre-treatment process which contained the elevated selenium and thallium was further treated through the use of adsorptive media. The limestone reduced the remaining cationic compounds to below effluent permitted limits. The selenium and thallium were reduced through the use of activated alumina. Activated alumina has been proven to be the best available technology by the EPA for reducing anionic compounds such as arsenic, selenium and thallium in wastewater as demonstrated in this treatability testing. Activated alumina is a proven technology to reduce these compounds detected in trace levels in wastewater effluent streams.

Sample analysis shows that thallium breakthrough occurred between a total volume of 6 liters and 24 liters passed through the activated alumina test column. The activated alumina media became saturated with dissolved metals and was unable to adsorb any other metals in the wastewater. Replacement of the media once breakthrough occurs will be determined by inline process sampling.

Certain samples were re-analyzed using lower reporting limits to determine if the non-detect values found in Table 1 were below the effluent permitted limits. Thallium had a lower discharge limit than what the analytical method's reporting limit provided, so samples were rerun using EPA Method 200.8 with lower detection limits to determine the value of the non-

detect contaminants. The results in Table 2 show that the non-detect thallium values were detected at the lower detection limit, but they still met effluent discharge limits.

The treatability study results indicate that the treatment process including aeration, hydroxide precipitation, followed by coagulation/flocculation/settling followed by the use of adsorptive media will reduce the contaminants of concern to below the Bremo discharge limits described in the draft permit. These unit operations will need to be operated in conjunction with one another in order to reduce the contaminants to below the permitted discharge limits.

We trust this report is fully responsive to your request. If you have any questions regarding this matter please contact me.

Best Regards,



Rob Orlando

Chief Engineer

www.gwttllc.com

627 Mt. Hope Road, Wharton, NJ 07885

Email: rorlando@gwttllc.com

Cell (973) 800 3531



Beyond Water Treatment

Table 2
Bremo East Pond PZ-2 Spiked Sample Treatability Testing Reruns

PARAMETER	EAST POND PZ-2 SPIKED SAMPLE FOR METALS REDUCTION														BREM PERMIT LIMITS						
	SPIKED SAMPLE				FILTER PRECIP	Q	LIME 3L	Q	LIME 6L	Q	LIME 24L	Q	LIME 29L	Q	LIME 67L	Q	RL	MDL	MONTHLY AVERAGE	DAILY MAXIMUM	
	TOTAL	Q	DISSOLVED	Q																	
Total Metals (ug/L)																					
Antimony	6.48		2.6	J	5.44		5.17		63		5.21		11		45		3		0.1	2100	2100
Selenium	16		14		9.6	J	9	J	10		13		11		9.7	J	10		3	9.6	18
Silver	ND		ND		ND		ND		ND		ND		ND		ND		1		0.1	2.7	5
Thallium	74		40		39		29		34		43		39		40		1		0.03	1.4	1.4
							AA 3L	Q	AA 6L	Q	AA 24L	Q	AA 29L	Q	AA 67L	Q	RL	MDL	MONTHLY AVERAGE	DAILY MAXIMUM	
Total Metals (ug/L)																					
Antimony							1.92	J	11	J	3.88		3.76		20		3		0.1	2100	2100
Selenium							ND		ND		6	J	6	J	7	J	10		3	9.6	18
Silver							ND		ND		ND		ND		ND		1		0.1	2.7	5
Thallium							0.32	J	0.86	J	7		8		12		1		0.03	1.4	1.4

NOTES

ND - Non Detect
NS - Not Sampled

Q - Qualifier
RL - Reporting Limit

U - Undetected
NL - No Limit

J - Estimated Concentration [Estimated Concentration is defined as less than the reporting limit (RL) but greater than the method

Highlighted Limits indicate that the concentration is greater than effluent discharge limit for the specified constituent

SPIKED is water from PZ-2 in which Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Thallium and Zinc were added to create a water sample that approximated historically and abnormally high concentrations of these constituents.

FILTER PRECIP is water that represents the effluent from the current treatment process. The current treatment process consists of chemical precipitation followed by mechanical filtration to 0.5 micron.

APPENDIX C
SAFETY DATA SHEETS



Univar USA Inc Material Safety Data Sheet

MSDS No:

Version No:

Order No:

Univar USA Inc., 17425 NE Union Hill Rd., Redmond WA 98052
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

Material Safety Data Sheet
Sodium Hypochlorite, 10-20% - Liquichlor
Revision Date 10/09/2009

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Sodium Hypochlorite, 10-20% - LIQUICHLOR
Synonyms : Sodium Hypochlorite - 18, Hypo, Liquid Bleach, Bleach,
Hypochlorite, Liquid Chlorine Solution, Javel Water
Chemical Family : Hypochlorite
Molecular formula : NaOCl
Product Use Description : Swimming pool chlorinator, hard surface cleaner,
mildecide, Water treatment chemical, Biocides, bleach
solutions and bleach fixer solutions

Distributed By:
Univar USA Inc.
17425 NE Union Hill Road
Redmond, WA 98085
425-889-3400

Emergency Phone Number : US: 1-800-424-9300 - CHEMTREC
CANADA: 1-800-567-7455

SECTION 2. HAZARDS IDENTIFICATION

/
HMIS Classification : Health Hazard: 3
Flammability: 0
Physical hazards: 2

NFPA Classification : Health Hazard: 3
Fire Hazard: 0
Reactivity Hazard: 1

Emergency Overview

OSHA Hazards : OXIDIZER, UNSTABLE (REACTIVE), CORROSIVE
Immediately Dangerous to Life or Health: Not established for the product.

Potential Health Effects

Primary Routes of Entry : Ingestion, Eyes, Inhalation, Skin Absorption
Aggravated Medical Condition : Asthma, Heart disease, Respiratory disorder
Inhalation : Inhalation of vapours is irritating to the respiratory system, may
cause throat pain and cough.
Inhalation of aerosol may cause irritation to the upper respiratory tract.
Higher exposure may cause lung oedema, circulatory collapse and unconsciousness.

Skin : May cause skin irritation and/or dermatitis.
Prolonged skin exposure may cause destruction of the dermis with impairment of
the skin to regenerate at site of contact.

Eyes : Causes serious eye irritation.
Blurred vision
May cause impairment of vision and corneal damage

Ingestion : Ingestion or inhalation of high concentrations may cause injuries to gastrointestinal tract, liver, kidneys and central nervous system. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Chronic Exposure : Repeated inhalation exposure may cause impairment of lung function and permanent lung damage.

Effects from chronic skin exposure would be similar to those from single exposure except for effects secondary to tissue destruction.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous components

Component	CAS-No.	Weight %
sodium hypochlorite	7681-52-9	10.00 - 20.00
sodium hydroxide	1310-73-2	1.00 - 5.00

SECTION 4. FIRST AID MEASURES

First aid procedures

Eye contact :

- IMMEDIATELY flush eyes with plenty of water holding eyelids apart for at least 15 minutes
- Get medical attention IMMEDIATELY.

Skin contact :

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

Ingestion :

- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to do so by the poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

Inhalation :

- Move person to fresh air.
- If breathing is difficult oxygen may be beneficial if administered by trained personnel.
- If breathing has stopped, apply artificial respiration.
- Call a physician or poison control center IMMEDIATELY.

General advice :
• Have the product container or label with you when calling a poison control center or doctor or going for treatment.
• Show this safety data sheet to the doctor in attendance.

Notes to physician
Comments :
• Probable mucosal damage may contraindicate the use of gastric lavage.

SECTION 5. FIRE-FIGHTING MEASURES

Flammable properties

Flash point : not applicable
Lower explosion limit : not applicable
Upper explosion limit : not applicable

Fire fighting

Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

On small fire, use dry chemical, carbon dioxide or water spray.

On large fires, use water in flooding quantities as fog.

Unsuitable extinguishing media : Do not use Mono Ammonium Phosphate (MAP) type extinguishers directly on this product

Further information : Cool containers / tanks with water spray.

Protective equipment and precautions for firefighters

Specific hazards during fire fighting : Corrosive

Special protective equipment for fire-fighters : Additional protective clothing must be worn to prevent personal contact with this material. Those items include but are not limited to: boots gloves, hard hat, splash-proof goggles, full face shield and impervious clothing, i.e. chemically impermeable suit.

Compatible materials for response to this material are neoprene and butyl rubber.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions : Restrict access to affected area.

Use personal protective equipment.

Use NIOSH approved respiratory protection. Keep people away from and upwind of spill/leak.

Methods for containment / : Try to prevent the material from entering drains or water courses.

Methods for cleaning up : Prevent further leakage or spillage if safe to do so.

Inform the responsible authorities in case of gas leakage, or of entry into waterways, soil or drains.

Will form hazardous reaction products

Suppress (knock down) gases/vapours/mists with a water spray jet. Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a suitable container for disposal according to local / state / province/national regulations (see section 13).

Additional advice : Dispose of as hazardous waste in compliance with local, province, state and federal regulations.

You are requested to contact the emergency numbers listed below before beginning any such operation.

FOR ALL ACCIDENTS, CALL CHEMTREC AT 800-424-9300 OR CANADA AT 1-800-567-7455.

SECTION 7. HANDLING AND STORAGE

Handling

Handling : Personnel working with this chemical should be trained on its hazards.

- Avoid contact with skin and eyes.
- Do not ingest.
- Avoid inhalation of vapour or mist.
- Wear personal protective equipment.
- For personal protection see section 8.

Advice on protection against fire : Normal measures for preventive fire protection. and explosion

Storage

Requirements for storage areas and containers : Do not freeze.

- Store in a cool and shaded area.
- Keep in a well-ventilated place.
- To maintain product quality, do not store in heat or direct sunlight.
- Decomposition rate increases as it is heated.
- Keep in properly labeled containers.
- Keep container closed when not in use.

Store at temperatures not exceeding : 86 F (30 C)

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Guidelines

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Update	Basis
sodium hydroxide	1310-73-2	CEIL	2 mg/m3	1994-09-01	ACGIH
		TWA	2 mg/m3	1993-06-30	OSHA P1

Engineering measures

Engineering measures : Use local exhaust ventilation to maintain levels to below the PEL.

Personal protective equipment

Eye protection : Ensure that eyewash stations and safety showers are close to the workstation location. Chemical resistant goggles must be worn.

Skin and body protection : Boots. Full protective suit Wear protective gloves.

Respiratory protection : Sudden release of chlorine hazard. If air concentrations above the PEL are possible, wear a NIOSH approved respirator. Wear respiratory equipment when entering the spray area.

Hygiene measures : • General industrial hygiene practice.

Suitable material	Boots.	Gloves	Protective suit
	Neoprene	Neoprene	Neoprene
	butyl-rubber	butyl-rubber	butyl-rubber
	PVC	PVC	PVC
	Viton ®	Viton ®	Viton
	Saranex®	Saranex®	Saranex®

The listed materials are guidelines only and there are numerous PPE alternatives depending on the site specifics of where the chemical is used. You should always consult with your PPE supplier for the correct tested material. Before using this chemical you should be aware of its hazards and be knowledgeable of emergency procedures in the event of a spill.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES Appearance

Form : liquid
Color : yellow to yellowish green
Odor : pungent

Safety data

Flash point : not applicable
Lower explosion limit : not applicable
Upper explosion limit : not applicable
Autoignition temperature : not applicable
Molecular Weight : 74.5 g/mol
pH : 12 - 14 at 77 F (25 C)
Freezing point : -17 F (-27 C) 16% Solution
Boiling point/boiling range : Decomposes on heating.
Vapor pressure : 12 mmHg at 68 F (20 C) 12.5% Solution
Bulk density : not applicable
Water solubility : completely miscible
Evaporation rate : no data available

SECTION 10. STABILITY AND REACTIVITY

Conditions to avoid : High heat, sunlight and ultra-violet light

Materials to avoid : Oxidizing agents, Acids, Nitrogen containing organics, Metals, Iron, Copper, Nickel, Cobalt, Organic materials, Ammonia

Hazardous decomposition products : Decomposition will result in the formation of oxygen from contact with copper, nickel, cobalt and iron solids such as rust. Decomposition rate increases as it is heated.
May develop chlorine if mixed with acidic solutions.

Thermal decomposition : Decomposition rate increases as it is heated.
Hazardous polymerization : Does not occur.

SECTION 11. TOXICOLOGICAL INFORMATION

Human Threshold Response

Odor threshold : approximately 0.9 mg/m³ (0.3 ppm) pungent
Irritation Threshold : no data available
Immediately Dangerous to Life or Health: Not established for the product.

Animal Toxicology
Acute oral toxicity : LD50 rat
Dose: 3 - 5 g/kg
Acute dermal toxicity : LD50 rabbit
Dose: > 2 g/kg
Acute inhalation toxicity : LC50
no data available

SECTION 12. ECOLOGICAL INFORMATION

Acute Fish toxicity : LC50 Bluegill sunfish: 2.90 mg/L
Exposure time: 96 Hour
LC50 Pimephales promelas (fathead minnow): 1.40 mg/L
Exposure time: 96 Hour
LC50 Oncorhynchus mykiss (rainbow trout): 0.90 mg/L
Exposure time: 0.5 Hour

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Classification : If this product becomes a waste, it meets the criteria of a hazardous waste as defined under 40 CFR 261 and would have the following: D002

Further information : If this product becomes a hazardous waste, it will be a hazardous waste which is subject to the Land Disposal Restrictions under 40 CFR 268 and must be managed accordingly.

Dispose of as hazardous waste in compliance with local, province, state and federal regulations.

CARE MUST BE TAKEN TO PREVENT ENVIRONMENTAL CONTAMINATION FROM THE USE OF THIS MATERIAL. THE USER OF THIS MATERIAL HAS THE RESPONSIBILITY TO DISPOSE OF UNUSED MATERIAL, RESIDUES AND CONTAINERS IN COMPLIANCE WITH ALL RELEVANT LOCAL, PROVINCE, STATE AND FEDERAL LAWS AND REGULATIONS REGARDING TREATMENT, STORAGE AND DISPOSAL FOR HAZARDOUS AND NON HAZARDOUS WASTES.

SECTION 14. TRANSPORT INFORMATION

DOT Proper shipping name: Hypochlorite Solutions
UN-Number: UN1791
Class: 8
Packing group: III
Hazard Labels/Placard: 8
Emergency Response: 154
Guidebook Number
Reportable Quantity: 100 LB
(Per 49 CFR 172.101, Appendix)

TDG CLR

Proper shipping name: Hypochlorite Solutions
UN-Number: UN1791
Class: 8
Packing group: III
Hazard Labels/Placard: 8

IATA

UN-Number: UN1791
Description of the goods: Hypochlorite Solutions
Class: 8
Packaging group: III
ICAO-Labels: 8

IMDG

UN-Number: UN1791
Description of the goods: Hypochlorite Solutions
Class: 8
Packaging group: III
IMDG-Labels: 8
Marine pollutant: no
See regulations for further information.

FOR ALL ACCIDENTS, CALL CHEMTREC AT 800-424-9300 OR CANADA AT 1-800-567-7455.

SECTION 15. REGULATORY INFORMATION

CANADIAN CLASSIFICATION

WHMIS Classification : E Corrosive Material

NPRI Components : Hypochlorous acid, sodium salt 7681-52-9
Sodium hydroxide (Na(OH)) 1310-73-2

Canadian National Pollutant Release Inventory (NPRI): No component is listed on NPRI.

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

US CLASSIFICATION

OSHA Hazards: Oxidizer, Unstable (reactive), Corrosive

CERCLA: 100 lbs

SARA 311/312 Hazards: Acute Health Hazard
Chronic Health Hazard
Reactivity Hazard

ECPRA - Emergency Community Planning Right-to-Know

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US STATE REGULATIONS

Massachusetts Right To Know Components: Hypochlorous acid, sodium salt 7681-52-9
1991-07-01
Sodium hydroxide (Na(OH)) 1310-73-2
1991-07-01

Pennsylvania Right To Know Components: Hypochlorous acid, sodium salt 7681-52-9
1991-07-01
Sodium hydroxide (Na(OH)) 1310-73-2
1991-07-01
Sodium chloride (NaCl) 7647-14-5
Water 7732-18-5
Carbonic acid disodium salt 497-19-8

New Jersey Right To Know: Water 7732-18-5
Components
Hypochlorous acid, sodium salt 7681-52-9
1991-07-01
Sodium chloride (NaCl) 7647-14-5
Sodium hydroxide (Na(OH)) 1310-73-2
1991-07-01

California Prop 65 Components: This product is not listed, but it may contain elements known to the State of California to cause cancer or reproductive toxicity as listed under Proposition 65 State Drinking Water and Toxic Enforcement Act.

GLOBAL INVENTORIES

The components of this product are reported in the following inventories:

EINECS On the inventory, or in compliance with the inventory
TSCA On TSCA Inventory
AICS On the inventory, or in compliance with the inventory
DSL All components of this product are on the Canadian DSL list.
ENCS On the inventory, or in compliance with the inventory
KECI On the inventory, or in compliance with the inventory
PICCS On the inventory, or in compliance with the inventory
IECSC On the inventory, or in compliance with the inventory
NZIoC On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

Univar USA Inc Material Safety Data Sheet

For Additional Information contact MSDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process



Univar USA Inc Material Safety Data Sheet

MSDS No:

Version No:

Order No:

Univar USA Inc., 17425 NE Union Hill Rd., Redmond WA 98052
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: HYDROGEN PEROXIDE 20-40%

SDS DATE: 06/19/2014
REPLACES: 09/26/2013

SAFETY DATA SHEET

This Safety Data Sheet conforms to ANSI Z400.5, and to the format requirements and the International Chemical Safety Cards of the Global Harmonizing System.

THIS SDS COMPLIES WITH 29 CFR 1910.1200 (HAZARD COMMUNICATION STANDARD)

IMPORTANT: Read this SDS before handling & disposing of this product.

Pass this information on to employees, customers, & users of this product.

SECTION 1. IDENTIFICATION OF THE SUBSTANCE OR MIXTURE AND OF THE SUPPLIER

PRODUCT IDENTITY: HYDROGEN PEROXIDE 20-40%
SDS NUMBER: CDS-1660
COMPANY IDENTITY: Univar
COMPANY ADDRESS: 17425 NE Union Hill Road
COMPANY CITY: Redmond, WA 98052
COMPANY PHONE: 1-425-889-3400
EMERGENCY PHONES: CHEMTREC: 1-800-424-9300 (USA)
CANUTEC: 1-613-996-6666 (CANADA)



SECTION 2. HAZARDS IDENTIFICATION

DANGER!!

HAZARD STATEMENTS:

H100s = General, H200s = Physical, H300s = Health, H400s = Environmental

H220 Harmful if inhaled.
H240+242 Heating may cause an explosion or fire.
H271 May cause fire or explosion; Strong Oxidizer.
H290 May be corrosive to metals.
H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.

PRECAUTIONARY STATEMENTS:

P100s = General, P200s = Prevention, P300s = Response, P400s = Storage, P500s = Disposal

P210 Keep away from heat/sparks/open flames/hot surfaces.
P220 Keep/Store away from clothing and combustible materials.
P234 Keep only in original container.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink, or smoke when using this product.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P301+312 IF SWALLOWED: call a POISON CENTER or doctor/physician IF you feel unwell,
P330 Rinse mouth.
P370+378 In case of fire: Use water spray for extinction.
P370+380+375 In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.
P403+235 Store in a well-ventilated place. Keep cool.
P411 Store at temperatures not exceeding 40 C / 104 F.
P420 Store away from other materials.
P501 Dispose of contents/container to appropriate waste site or reclaimer in accordance with local and national regulations.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

MATERIAL	CAS#	EINECS#	WT %
Water	7732-18-5	231-791-2	60-80
Hydrogen Peroxide	7722-84-1	231-765-0	20-40

SEE SECTIONS 8, 11 & 12 FOR TOXICOLOGICAL INFORMATION.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: HYDROGEN PEROXIDE 20-40%

SDS DATE: 06/19/2014
REPLACES: 09/26/2013

TRACE COMPONENTS: Trace ingredients (if any) are present in < 1% concentration, (< 0.1% for potential carcinogens, reproductive toxins, respiratory tract mutagens, and sensitizers). None of the trace ingredients contribute significant additional hazards at the concentrations that may be present in this product. All pertinent hazard information has been provided in this document, per the requirements of the Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalents, and Canadian Hazardous Materials Identification System Standard (CPR 4).

SECTION 4. FIRST AID MEASURES

GENERAL ADVICE:

First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists, refer to Section 8 for specific personal protective equipment.

EYE CONTACT:

If this product enters the eyes, open eyes while under gently running water. Use sufficient force to open eyelids. "Roll" eyes to expose more surface. Minimum flushing is for 15 minutes. Seek immediate medical attention.

SKIN CONTACT:

If the product contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove contaminated clothing, taking care not to contaminate eyes. If skin becomes irritated and irritation persists, medical attention may be necessary. Wash contaminated clothing before reuse, discard contaminated shoes.

INHALATION:

After high vapor exposure, remove to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, trained personnel should immediately begin artificial respiration. If the heart has stopped, trained personnel should immediately begin cardiopulmonary resuscitation (CPR). Seek immediate medical attention.

SWALLOWING:

If swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, give two glasses of water to drink. DO NOT INDUCE VOMITING. Never induce vomiting or give liquids to someone who is unconscious, having convulsions, or unable to swallow. Seek immediate medical attention.

NOTES TO PHYSICIAN:

There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Any material aspirated during vomiting may cause lung injury. Therefore, emesis should not be induced mechanically or pharmacologically. If it is considered necessary to evacuate the stomach contents, this should be done by means least likely to cause aspiration (such as: Gastric lavage after endotracheal intubation).

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take a copy of label and SDS to physician or health professional with victim.

SECTION 5. FIRE FIGHTING MEASURES

FIRE & EXPLOSION PREVENTIVE MEASURES

Isolate from other materials. Isolate from heat, sparks, electrical equipment and open flame.

EXTINGUISHING MEDIA

Use water spray, or water fog extinguishing media.

SPECIAL FIRE FIGHTING PROCEDURES

Water spray may be ineffective on fire but can protect fire-fighters & cool closed containers. Use fog nozzles if water is used. Do not enter confined fire-space without full bunker gear. (Helmet with face shield, bunker coats, gloves & rubber boots). Use NIOSH approved positive-pressure self-contained breathing apparatus.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: HYDROGEN PEROXIDE 20-40%

SDS DATE: 06/19/2014
REPLACES: 09/26/2013

SECTION 5. FIRE FIGHTING MEASURES (CONTINUED)

UNUSUAL EXPLOSION AND FIRE PROCEDURES STRONG OXIDIZER!

Isolate from other materials, heat, sparks, electrical equipment & open flame.
Closed containers may explode if exposed to extreme heat.
Applying to hot surfaces requires special precautions.

SECTION 6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE AND ENVIRONMENTAL PRECAUTIONS:

Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area, protect people, and respond with trained personnel.

PERSONAL PROTECTIVE EQUIPMENT

The proper personal protective equipment for incidental releases (such as: 1 Liter of the product released in a well-ventilated area), use impermeable gloves (triple-gloves (rubber gloves and nitrile gloves, over latex gloves), goggles, face shield, and appropriate body protection. In the event of a large release, use impermeable gloves, specific for the material handled, chemically resistant suit and boots, and hard hat. Self-Contained Breathing Apparatus or respirator may be required where engineering controls are not adequate or conditions for potential exposure exist. When respirators are required, select NIOSH/MSHA approved based on actual or potential airborne concentrations in accordance with latest OSHA and/or ANSI recommendations.

ENVIRONMENTAL PRECAUTIONS:

Stop spill at source. Construct temporary dikes of dirt, sand, or any appropriate readily available material to prevent spreading of the material. Close or cap valves and/or block or plug hole in leaking container and transfer to another container. Keep from entering storm sewers and ditches which lead to waterways, and if necessary, call the local fire or police department for immediate emergency assistance.

CONTAINMENT AND CLEAN-UP MEASURES:

Absorb spilled liquid with polypads or other suitable absorbent materials. If necessary, neutralize using suitable buffering material, (acid with soda ash or base with phosphoric acid), and test area with litmus paper to confirm neutralization. Clean up with non-combustible absorbent (such as: sand, soil, and so on). Shovel up and place all spill residue in suitable containers. dispose of at an appropriate waste disposal facility according to current applicable laws and regulations and product characteristics at time of disposal (see Section 13 - Disposal Considerations).

SECTION 7. HANDLING AND STORAGE

HANDLING

Use only with adequate ventilation. Wear OSHA Standard goggles or face shield. Consult Safety Equipment Supplier. Wear goggles, face shield, gloves, apron & footwear impervious to material. Wash clothing before reuse.

STORAGE

Isolate from other materials, heat, sparks, electrical equipment & open flame.
Do not store above 49 C/120 F.
Keep container tightly closed & upright when not in use to prevent leakage.

NONBULK: CONTAINERS:

Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers or in a diked area, as appropriate. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Empty containers should be handled with care. Never store food, feed, or drinking water in containers which held this product.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: HYDROGEN PEROXIDE 20-40%

SDS DATE: 06/19/2014
REPLACES: 09/26/2013

SECTION 7. HANDLING AND STORAGE (CONTINUED)

BULK CONTAINERS:

All tanks and pipelines which contain this material must be labeled. Perform routine maintenance on tanks or pipelines which contain this product. Report all leaks immediately to the proper personnel.

TANK CAR SHIPMENTS:

Tank cars carrying this product should be loaded and unloaded in strict accordance with tank-car manufacturer's recommendation and all established on-site safety procedures. Appropriate personal protective equipment must be used (see Section 8, Engineering Controls and Personal Protective Equipment.). All loading and unloading equipment must be inspected, prior to each use. Loading and unloading operations must be attended, at all times. Tank cars must be level, brakes must be set or wheels must be locked or blocked prior to loading or unloading. Tank car (for loading) or storage tanks (for unloading) must be verified to be correct for receiving this product and be properly prepared, prior to starting the transfer operations. Hoses must be verified to be in the correct positions, before starting transfer operations. A sample (if required) must be taken and verified (if required) prior to starting transfer operations. All lines must be blown-down and purged before disconnecting them from the tank car or vessel.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:

Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Collect all rinsates and dispose of according to applicable Federal, State, Provincial, or local procedures.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

MATERIAL	CAS#	EINECS#	TWA (OSHA)	TLV (ACGIH)
Water	7732-18-5	231-791-2	None Known	None Known
Hydrogen Peroxide	7722-84-1	231-765-0	1 ppm	1 ppm

This product contains no EPA Hazardous Air Pollutants (HAP) in amounts > 0.1%.

RESPIRATORY EXPOSURE CONTROLS

Maintain airborne contaminant concentrations below exposure limits given above. If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134, European Standard EN 149, or applicable State regulations. If adequate ventilation is not available or there is potential for airborne exposure above the exposure limits, a respirator may be worn up to the respirator exposure limitations, check with respirator equipment manufacturer's recommendations/limitations. For a higher level of protection, use positive pressure supplied air respiration protection or Self-Contained Breathing Apparatus or if oxygen levels are below 19.5% or are unknown.

EMERGENCY OR PLANNED ENTRY INTO UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS

Positive pressure, full-face piece Self-Contained Breathing Apparatus; or positive pressure, full-face piece Self-Contained Breathing Apparatus with an auxiliary positive pressure Self-Contained Breathing Apparatus.

VENTILATION

LOCAL EXHAUST: Necessary MECHANICAL (GENERAL): Necessary
SPECIAL: None OTHER: None
Please refer to ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

EYE PROTECTION:

Splash goggles or safety glasses. Face-shields are recommended when the operation can generate splashes, sprays or mists.

HAND PROTECTION:

Wear appropriate impervious gloves for routine industrial use. Use impervious gloves for spill response, as stated in Section 6 of this SDS (Accidental Release Measures).

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: HYDROGEN PEROXIDE 20-40%

SDS DATE: 09/26/2013
REPLACES: 09/08/2010

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION (CONTINUED)

NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

BODY PROTECTION:

Use body protection appropriate for task. Cover-all, rubber aprons, or chemical protective clothing made from impervious materials are generally acceptable, depending on the task.

WORK & HYGIENIC PRACTICES:

Provide readily accessible eye wash stations & safety showers. Wash at end of each shift & before eating, smoking or using the toilet. Remove clothing that becomes contaminated. Destroy contaminated leather articles. Launder or discard contaminated clothing.

SECTION 9. PHYSICAL & CHEMICAL PROPERTIES

APPEARANCE:	Liquid, Water-White
ODOR:	None
ODOR THRESHOLD:	Not Available
pH (Neutrality):	< 3.7
MELTING POINT/FREEZING POINT:	-15 to -33 C / +6 to -27 F
BOILING RANGE (IBP,50%,Dry Point):	100 108 176 C / 212 227 350 F
FLASH POINT (TEST METHOD):	Not Applicable
EVAPORATION RATE (n-BUTYL ACETATE=1):	0.094
FLAMMABILITY CLASSIFICATION:	Non-Combustible
LOWER FLAMMABLE LIMIT IN AIR (% by vol):	Not Applicable
UPPER FLAMMABLE LIMIT IN AIR (% by vol):	Not Applicable
VAPOR PRESSURE (mm of Hg)@20 C	23 - 28
VAPOR DENSITY (air=1):	0.772
GRAVITY @ 68/68 F / 20/20 C:	
SPECIFIC GRAVITY (Water=1):	1.33
POUNDS/GALLON:	9.45
WATER SOLUBILITY:	Complete
PARTITION COEFFICIENT (n-Octane/Water):	Not Available
AUTO IGNITION TEMPERATURE:	Not Applicable
DECOMPOSITION TEMPERATURE:	Not Available
VOCs (>0.044 Lbs/Sq In) :	0.0 Vol% /0.0 g/L / 0.000 Lbs/Gal
TOTAL VOC'S (TVOC)*:	0.0 Vol% /0.0 g/L / 0.000 Lbs/Gal
NONEXEMPT VOC'S (CVOC)*:	0.0 Vol% /0.0 g/L / 0.000 Lbs/Gal
HAZARDOUS AIR POLLUTANTS (HAPS):	0.0 Wt% /0.0 g/L / 0.000 Lbs/Gal
NONEXEMPT VOC PARTIAL PRESSURE (mm of Hg @ 20 C)	0.0

* Using CARB (California Air Resources Board Rules).

SECTION 10. STABILITY & REACTIVITY

STABILITY

Stable under normal conditions.

CONDITIONS TO AVOID

Excessive heat or contamination could cause the product to become unstable.

MATERIALS TO AVOID

Dirt, Cyanides, Reducing agents, wood, paper, other organics and combustibles, iron and other heavy metals, copper alloys and caustics.

HAZARDOUS DECOMPOSITION PRODUCTS

Oxygen (which supports combustion).

HAZARDOUS POLYMERIZATION

Will not occur.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: HYDROGEN PEROXIDE 20-40%

SDS DATE: 06/19/2014
REPLACES: 09/26/2013

SECTION 11. TOXICOLOGICAL INFORMATION

ACUTE HAZARDS

EYE & SKIN CONTACT:

Primary irritation to skin, defatting, dermatitis.
Liquid is extremely irritating/corrosive to eyes, and may cause irreversible damage including blindness.
Wash thoroughly after handling.

INHALATION:

Anesthetic. Irritates respiratory tract. Acute overexposure can cause serious nervous system depression. Vapor harmful.

SWALLOWING:

Swallowing can cause abdominal irritation, nausea, vomiting & diarrhea.

SUBCHRONIC HAZARDS/CONDITIONS AGGRAVATED

CONDITIONS AGGRAVATED

Persons with severe skin, liver or kidney problems should avoid use.

CHRONIC HAZARDS

CANCER, REPRODUCTIVE & OTHER CHRONIC HAZARDS:

This product has no carcinogens listed by IARC, NTP, NIOSH, OSHA or ACGIH, as of this date, greater or equal to 0.1%.

SECTION 11. TOXICOLOGICAL INFORMATION (CONTINUED)

IRRITANCY OF PRODUCT: This product is irritating to contaminated tissue.

SENSITIZATION TO THE PRODUCT: No component of this product is known to be a sensitizer.

MUTAGENICITY: This product is not reported to produce mutagenic effects in humans.

EMBRYOTOXICITY: This product is not reported to produce embryotoxic effects in humans.

TERATOGENICITY: This product is not reported to produce teratogenic effects in humans.

REPRODUCTIVE TOXICITY: This product is not reported to cause reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (such as: within the eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MAMMALIAN TOXICITY INFORMATION

LD50 (Oral):	1193 mg/kg (Rats)
LC50 (Inhalation):	> 0.17 mg/L (Rats)
LD50 (Skin):	> 2000 mg/kg (Rabbits)

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: HYDROGEN PEROXIDE 20-40%

SDS DATE: 06/19/2014
REPLACES: 09/26/2013

SECTION 12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

EFFECT OF MATERIAL ON PLANTS AND ANIMALS:

This product may be harmful or fatal to plant and animal life if released into the environment. Refer to Section 11 (Toxicological Information) for further data on the effects of this product's components on test animals.

EFFECT OF MATERIAL ON AQUATIC LIFE:

No aquatic environmental information is available on this product.

MOBILITY IN SOIL

This material is a mobile liquid.

DEGRADABILITY

This product is completely biodegradable.

ACCUMULATION

This product does not accumulate or biomagnify in the environment.

SECTION 13. DISPOSAL CONSIDERATIONS

Processing, use or contamination may change the waste disposal requirements. Do not dispose of on land, in surface waters, or in storm drains. Waste should be recycled or disposed of in accordance with regulations. Large amounts should be collected for reuse or consigned to licensed hazardous waste haulers for disposal.

ALL DISPOSAL MUST BE IN ACCORDANCE WITH ALL FEDERAL, STATE, PROVINCIAL, AND LOCAL REGULATIONS. IF IN DOUBT, CONTACT PROPER AGENCIES. EPA CHARACTERISTIC: D001, D002

SECTION 14. TRANSPORT INFORMATION

DOT/TDG SHIP NAME: UN2014, Hydrogen peroxide, aqueous solutions, 5.1, (8), PG-II
DRUM LABEL: Oxidizer, Corrosive
IATA / ICAO: UN2014, Hydrogen peroxide, aqueous solutions, 5.1, (8), PG-II
IMO / IMDG: UN2014, Hydrogen peroxide, aqueous solutions, 5.1, (8), PG-II
EMERGENCY RESPONSE GUIDEBOOK NUMBER: 140

SECTION 15. REGULATORY INFORMATION

EPA REGULATION:

SARA SECTION 311/312 HAZARDS: Acute Health, Fire

All components of this product are on the TSCA list.
This material contains no known products restricted under SARA Title III, Section 313 in amounts greater or equal to 1%.



COMPANY IDENTITY: Univar
PRODUCT IDENTITY: HYDROGEN PEROXIDE 20-40%

SDS DATE: 06/19/2014
REPLACES: 09/26/2013

SECTION 15. REGULATORY INFORMATION (CONTINUED)

STATE REGULATIONS:

CALIFORNIA SAFE DRINKING WATER & TOXIC ENFORCEMENT ACT (PROPOSITION 65):
This product contains no chemicals known to the State of California
to cause cancer or reproductive toxicity.

INTERNATIONAL REGULATIONS

The components of this product are listed on the chemical inventories of the
following countries:
Australia (AICS), Canada (DSL or NDSL), China (IECSC), Europe (EINECS, ELINCS)G
Japan (METI/CSCL, MHLW/ISHL), South Korea (KECI), New Zealand (NZIoC),
Philippines (PICCS), Switzerland (SWISS), Taiwan (NECSI), USA (TSCA).

CANADA: WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)

C: Oxidizing Material.
D2B: Irritating to skin / eyes.
E: Corrosive Material.

This product has been classified in accordance with hazard criteria of the Controlled
Products Regulations (CPR) and the SDS contains all the information required by the CPR.

SECTION 16. OTHER INFORMATION

HAZARD RATINGS:

HEALTH (NFPA): 3, HEALTH (HMIS): 3, FLAMMABILITY: 0, PHYSICAL HAZARD: 1
(Personal Protection Rating to be supplied by user based on use conditions.)
This information is intended solely for the use of individuals
trained in the NFPA & HMIS hazard rating systems.

EMPLOYEE TRAINING

See Section 2 for Risk & Safety Statements. Employees should be made aware
of all hazards of this material (as stated in this SDS) before handling it.

Univar USA Inc Material Safety Data Sheet

For Additional Information contact MSDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process

**ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET**

Material Name: WC 500

October 9, 2014

SECTION 1 – GENERAL INFORMATION

Manufacturer/Supplier's Name: ADEGA CHEMICAL
25411 NE 53rd Street
Vancouver, Wa, 98682

PRODUCT AND TECHNICAL INFORMATION NUMBER: (949) 275-7208

Proper Shipping Name	(49CFR 172.101):	None
D.O.T. Hazard Name	(49CFR 172.101):	None
D.O.T. ID Number	(49CFR 172.101):	None
D.O.T. Hazard Class	(49CFR 172.101):	None
RCRA Hazard Class	(40CFR 261) (IF DISCARDED):	None
E.P.A. Priority Pollutants	(40 CFR 122.53):	None

U.S. NFPA: Health: 2; Flammability: 0; Reactivity: 0

US HMIS: Health Hazard: 2; Fire Hazard: 0; Physical Hazard: 0; Personal Protection: B

Generic Description: contains water soluble Dialuminum Chloride Pentahydroxide (Aluminum Chlorohydrate) in a 50 % w/w solution in water

**SECTION 2 – HAZARDS IDENTIFICATION
HAZARDOUS INGREDIENTS AS DEFINED IN 29 CFR 1910 1200**

Classification: Not Regulated, No Hazard
Label Elements: Not Regulated, No Hazard
Other Hazards: Not Regulated, No Hazard

CAS No: 12042-91-0	Ingredient: Dialuminum Chloride	Exposure Limits: OSHA PEL and ACG1H TLV for Aluminum, Soluble Salts:
EC No: 234-933-1	Pentahydroxide	TWA 2 MG/M3 as aluminum

Purity: 50 % Aluminum Chlorohydrate w/w Other Constituent: water

Impurities: None Additives: none

Hazard Ingredients: none

SECTION 3 – EFFECTS OF OVEREXPOSURE

EYES: Direct contact irritates slightly to moderately with redness and swelling

SKIN: A single relatively short exposure causes no known adverse effect. Repeated exposures may irritate.

INHALATION: Inhaling dust or mist created during use may injure the respiratory system and cause an adverse lung reaction.

**ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET**

Material Name: WC 500

October 9, 2014

ORAL: Small amounts transferred to the mouth by fingers during use, etc., should not injure. Swallowing large amounts may cause injury.

COMMENTS: This product, as with any chemical, may enhance allergic conditions on certain people.

SECTION 4 – EMERGENCY AND FIRST AID PROCEDURES

General Information: Immediate medical attention is typically not necessary unless ingested or in eyes

EYES: Immediately flush with lukewarm water, including under eyelids for 15 min. If symptoms persist, get immediate medical attention.

SKIN: Wipe off and flush with water, then wash with soap and water. If symptoms persist, get immediate medical attention

INHALATION: Supply fresh air. Rinse wouth and nose with water. Get medical attention if there is any discomfort.

ORAL: Never give anything by mouth to an unconscious person. Do not induce vomiting. Rinse mouth with water. Drink 1 or 2 glasses of water or milk. Get medical attention if large amount swallowed or there is any discomfort

SECTION 5 – FIRE AND EXPLOSION DATA

FLASH POINT (METHOD USED): NONE; NOT FLAMMABLE

EXTINGUISHING MEDIA: Cool containers with water fog

SPECIAL FIRE FIGHTING PROCEDURES:

Self-contained breathing apparatus and protective clothing should be worn in fighting fires involving chemicals.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

Excessive heating (after water evaporation) for long periods of time can result in the evolution of HCl.

SECTION 6 – PHYSICAL DATA

pH (20 °C): ~ 3.5 (neat), ~ 4 in a 15 % w/w solution

BOILING POINT (AT 760 MM HG):

Approx 212°F/100°C

SPECIFIC GRAVITY (AT 77 DEG. F / 25 DEG. C)

1.34

MELTING POINT:

Approx. 32°F / 0°C

**ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET**

Material Name: WC 500

October 9, 2014

VAPOR PRESSURE (AT 77 DEG F / 25 DEG C): 24 MM (water)

VAPOR DENSITY (AIR = 1 AT 77 DEG F / 25 DEG C): That of moist air

PERCENT VOLATILE BY WEIGHT (%): 50 (water)

EVAPORATION RATE (ETHER = 1): As water

SOLUBILITY IN WATER (%): Approx. 100

ODOR, APPEARANCE, COLOR: Clear (colorless to slight yellowish tint) liquid, with slight characteristic odor

NOTE: The above information is not intended for use in preparing product specifications, contact manufacturer before writing specifications.

SECTION 7 – STABILITY and REACTIVITY DATA

STABILITY: Stable

INCOMPATIBILITY (MATERIAL TO AVOID):
Will react with caustics will precipitate Aluminum Hydroxide.
Can corrode ordinary grades of steel

CONDITIONS TO AVOID: Exposure to above and continuous high temperatures.

HAZARDOUS DECOMPOSITION PRODUCTS: Excessive heating for long periods of time can result in the evolution of HCl.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 8 – SPILL, LEAK, MAINTENANCE / REPAIR AND DISPOSAL PROCEDURES

Steps to be taken in case material is released or spilled: Use absorbent material to collect and contain. Wash with clear water only

PERSONAL PROTECTIVE EQUIPMENT:

EYES: Safety glasses, as a minimum, goggles if splashing should occur.

SKIN: Washing at mealtime and end of shift is adequate.

INHALATION: No respiratory protection should be needed.

WASTE DISPOSAL METHOD:

Material is not a hazardous waste; manufacturer suggests that all Local, State and Federal Regulations concerning Health and pollution be reviewed to determine approved disposal procedures. Contact supplier/manufacturer if there are any Disposal questions.

D.O.T. (49CFR 171.8)/E.P.A (40CFR 117) SPILL REPORTING INFORMATION:

HAZARDOUS SUBSTANCE: None

REPORTABLE QUANTITY: Not Applicable

CONCENTRATION OF HAZARDOUS SUBSTANCE: Not Applicable

**ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET**

Material Name: WC 500

October 9, 2014

REPORTABLE QUANTITY OF PRODUCT: Not Applicable

COMMENTS: Product contains no ingredient subject to D.O.T. or E.P.A. CERCLA/SARA environmental release reporting regulations. See SEC. 11. For additional SARA compliance information.

SECTION 9 – ROUTINE HANDLING PRECAUTIONS

PERSONAL PROTECTIVE EQUIPMENT:

EYES: Safety glasses, as a minimum, goggles if splashing should occur.

SKIN*: Washing at mealtime and end of shift is adequate.

INHALATION: No respiratory protection should be needed unless mists are created.

VENTILATION: LOCAL EXHAUST: None should be needed.

MECHANICAL (GENERAL): Recommended

SUITABLE RESPIRATOR: Dust/Mist type

These precautions are for room temperature handling. Use at elevated temperatures, or aerosol / spray applications may require added precautions.

* Good practice requires that gross amount of any chemical be removed from the skin as soon as practical, especially before eating or smoking

COMMENTS: Avoid eye contact.

SECTION 10 – SPECIAL PRECAUTIONS

Use reasonable care and caution in handling and storage. Store between 32° F/0°C and 120°F/49°C.

SECTION 11 – TOXICOLOGICAL INFORMATION

This product is not classified under either the Dangerous Substance Directive or the GHS/CLP Regulation.

Acute Toxicity

Oral; Not classified – rat ingestion study, OECD 401, LD50 (rat) indicates > 2,000 mg/kg

Dermal; Not classified – rat dermal toxicity study, OECD 402, LD50 (rat) indicates > 2,000 mg/kg

Irritant or Corrosive Effects

Primary irritation to skin; Not classified - negative results rabbit skin, OECD 404

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET

Material Name: WC 500

October 9, 2014

Irritation to eyes; Not classified - negative results rabbit eye, OECD 405

Sensitization

Not classified. Negative result for Aluminum Hydroxy Chloride, CAS 1327-41-9

Specific Target Organ Toxicity (STOT)

Not classified. No STOT identified in animal studies. Human effects can be related to systemic toxicity

Repeated Dose Toxicity

Not classified. Read across from chronic (1 year) toxicity study (oral, rat) with Al Citrate, OECD 426, and OECD 452. Read across from short term repeat dose toxicity study (rat) with Aluminum Hydroxy Chloride, CAS 1327-41-9.

Carcinogenicity

Not classified. No studies; none expected

Mutagenicity/Genotoxicity

Not classified. Negative results for in-vitro mutagenicity testing

Toxicity for Reproduction

Not classified. Read across from Aluminum Hydroxy Chloride reproductive/developmental toxicity screening test. NOEL 1000 mg/kg/day (equivalent to 90 mg/kg bw/day Al³⁺) and Aluminum Citrate one year developmental and chronic neurotoxicity study (oral, rat).

SECTION 12 – ECOLOGICAL INFORMATION

Aquatic Toxicity:

P. Promelas LC₅₀ (72h) > 1000 mg/L, LC₅₀ (96h) 720 mg/L; EC₅₀ (72h) 316 mg/L, EC₅₀ (96h) 40 mg/L
C. Dubia LC₅₀ (24h) > 1000 mg/L, LC₅₀ (48h) 0.32 mg/L; EC₅₀ (24h) 316 mg/L, EC₅₀ (48h) < 0.1 mg/L
Zebra fish LC₅₀ (96h) 100 – 500 mg/l (OECD 203), Daphnia Magna EC₅₀ (48h) 397mg/l,
EC₅₀ (bacteria) > 1000 mg/l Fermentation tube test.

Mobility

Not classified based on rapid hydrolysis and precipitation.

Persistence and Degradability

Inorganic product, not degradable. Cannot be eliminated from water by biological purification processes.

Results of PBT Assessment

Substance is not toxic.

SECTION 11 – COMMENTS

Additional SARA regulatory compliance information

SEC. 312 HAZARD CLASS: Immediate

SEC. 313 NOTIFICATION: Not Applicable; either none present or none present in regulated quantities.

These data are offered in good faith as typical values and not as a product specification. No warranty, either expressed or implied, is hereby made. The recommended industrial hygiene and safe handling procedures are believed to be generally applicable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate.



Univar USA Inc.
6100 Carillon Point
Kirkland, WA 98033
(425) 889-3400

For Emergency Assistance involving chemicals call - CHEMTREC (800) 424-9300

The Version Date for this MSDS is : 03/06/2003

PRODUCT IDENTIFICATION

PRODUCT NAME: FERRIC CHLORIDE SOLUTION
MSDS NUMBER: P21925VS
DATE ISSUED: 01/02/03
SUPERCEDES: 10/22/01
ISSUED BY: 000099

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Ferric Chloride - Drinking Water Grade
Chemical Name/Synonyms: Iron (III) Chloride Solution
Chemical Formula: FeCl3
Cas Number: 7705-08-0
HS Tariff Classification Number: data not available
Tax ID Number: data not available

Distributed by:
Univar USA
6100 Carillon Pt.
Kirkland, WA 98033

**FOR TRANSPORTATION EMERGENCY ONLY, 24 HOURS EVERYDAY,
CALL** **CHEMTREC, 1-800-424-9300**

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS Registry #	% by weight
Ferric Chloride	7705-08-0	37 - 45
Water	7732-18-5	Balance

Hazardous Ingredients: Ferric Chloride
Exposure Limits (ppm):

Component	OSHA TLV	ACGIH TLV	NIOSH
Ferric Chloride (as soluble iron salts)	1 mg/m3, 8-hr TWA	1 mg/m3, 8-hr TWA	1 mg/m3, 8-hr TWA

3. HAZARDS IDENTIFICATION

Emergency Overview

A reddish brown liquid with a slight odor of iron/acid. Avoid inhaling concentrated vapor or mist, may cause irritation of respiratory tract. May result in severe liver and/or kidney damage, if swallowed, and can be fatal. Do not induce vomiting. Avoid contact with skin. Liquid, mist, or vapor can cause irritation to all human tissue. Contact with eyes can result in visual loss unless removed quickly by thorough irrigation with water. Caution: May release irritating and toxic gases of hydrogen chloride during fire. Contain spills and keep liquid out of water sources. See Sections 3, 4, 5, and 6.

Potential Health Effects (Acute and Chronic)

INHALATION: Inhalation of concentrated mist or vapor may cause irritation of the respiratory tract.

INGESTION: Ingestion may cause severe liver and/or kidney damage, and may be fatal.

DIRECT CONTACT: The product is an irritant. Contact may include irritation with dryness, discomfort or rash. Ferric chloride has been infrequently associated with skin sensitization in humans. Extensive exposure could lead to skin sensitization

DIRECT EYE CONTACT: Contact with eyes may cause irritation and tearing and eye tissue discoloration, and may result in permanent visual loss unless removed quickly by thorough irrigation with water.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known.

CARCINOGENS (NTP, IARC, or OSHA): No

4. FIRST AID MEASURES:

INHALATION: Remove victim to fresh air. If not breathing, perform artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention.

INGESTION: If swallowed, do NOT induce vomiting. Give victim water or milk. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.

DIRECT CONTACT: Flush with water until material is removed. Remove contaminated clothing. Wash clothing before reuse.

DIRECT EYE CONTACT: Immediately flush with water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of eye/lid tissue. Get immediate medical attention.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

Flammability: Product not flammable.
Flash Point: not applicable
Method used: TCC

OXIDIZING PROPERTIES: data not available

AUTOFLAMMABILITY: not applicable

AUTOIGNITION TEMPERATURE: not applicable

FLAMMABLE LIMITS, % BY VOLUME:

Lower flammable limit: not applicable
Upper flammable limit: not applicable

EXTINGUISHING MEDIA: Use water spray, fog, foam, dry chemical, CO2 or other agents as appropriate for surrounding fire.

FIRE FIGHTING INSTRUCTIONS: As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. During fire, irritating and toxic gases of hydrogen chloride may be generated by thermal decomposition. Cool exterior of storage tanks.

FIRE AND EXPLOSION HAZARDS: None

SENSITIVITY TO MECHANICAL IMPACT/STATIC DISCHARGE: not applicable

6. ACCIDENTAL RELEASE MEASURES

Contain spill in order to prevent contamination of water way; neutralize with lime or soda ash. Flush with water in accordance with applicable regulations to waste treatment system. Avoid runoff into storm sewers and ditches which lead to waterways. Spills of 1000 pounds (454 kilograms) or more must be reported to the National Response Center, (800) 424-8802. If water pollution occurs, notify the appropriate authorities.

7. HANDLING AND STORAGE

Store away from heat, strong alkalis (such as caustic soda and alkali metals). Keep containers closed and dry. Protect container from physical damage. Use handling equipment (pumps, hoses, etc.) compatible with product, i.e., polyethylene, polypropylene, PVC, Teflon, rubber, FRP, and titanium. See Section 10 for types of packaging materials to avoid. Avoid contact with bare metals other than titanium. Avoid breathing vapors and/or mist. Avoid contact with eyes and skin. Wash thoroughly after handling. Follow all MSDS/label precautions even after container is emptied because they may retain vapor and product residues.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION: Good general ventilation should be sufficient to control airborne levels of vapor and mist.

RESPIRATORY PROTECTION: If airborne concentrations exceed the published exposure limits use NIOSH/MSHA approved, full face respirator as appropriate. Consult respirator manufacturer to determine appropriate equipment.

PROTECTIVE GLOVES: Wear impervious rubber gloves.

EYE PROTECTION: Wear splash proof chemical safety goggles. Do not wear contact lenses.

OTHER PROTECTIVE EQUIPMENT: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

WORK/HYGIENIC PRACTICES: Avoid ingestion and breathing mist. Ferric Chloride will permanently stain clothing and temporarily stain skin. Avoid contact with skin and clothing. Wash thoroughly after handling.

OTHER PRECAUTIONS: None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: reddish brown
Odor: slightly iron/acid
Odor Threshold: data not available
Physical State: liquid
Vapor Pressure (REID): negligible
Specific Gravity: 40% solution = 1.432 at 17.50 C (water = 1)
Solubility in Water: complete
pH: <2.0
Boiling Point: 230 0 F or 1100 C
Vapor Density: not applicable (Air = 1)
Evaporation Rate: 1 (Butyl Acetate = 1)
Freezing Point: (-58)0 F or (-500)C
Coefficient of Water/Oil Distribution: not applicable
Viscosity: data not available
% Solids: not applicable
% VOC: not applicable

For information on FLASH POINT, FLAMMABILITY, OXIDIZING PROPERTIES AUTOFLAMMABILITY, and EXPLOSIVE PROPERTIES, please see Section 5.

10. STABILITY AND REACTIVITY

GENERAL: This product is stable and hazardous polymerization will not occur.

INCOMPATIBLE MATERIALS AND CONDITIONS TO AVOID: Material is stable when properly handled. Material is acidic and corrodes all common metals except titanium. Avoid contact with strong alkalis and alkali metals.

HAZARDOUS DECOMPOSITION PRODUCTS: May release hydrogen chloride gas at elevated temperatures.

11. TOXICOLOGICAL INFORMATION

Immediate Effects: Can cause severe liver and/or kidney damage if swallowed, and may even be fatal. See Section 3 for other immediate health hazards.

12. ECOLOGICAL INFORMATION

Fat Head Minnows LC50 > 1000 ppm ; Daphnia Magna LC50 > 1000 ppm

13. DISPOSAL CONSIDERATIONS

Dispose of spilled, neutralized, or waste product, contaminated soil and other contaminated materials in accordance with all local, state and federal regulations.

14. TRANSPORT INFORMATION

DOT (Department of Transportation)
Proper Shipping Name: Ferric Chloride, Solution
Hazard Class: 8
Identification Number: UN2582
Packing Group: III
Label: Corrosive
Emergency Response Guide Book Number: 154
Corrosive: To metals only (not to skin)

15. REGULATORY INFORMATION

U.S. Federal Regulations:

OSHA:

This product is hazardous by definition of Hazard Communication Standard (29CFR1910.1200).

SARA TITLE III (Superfund Amendments and Reauthorization Act of 1986)

Section 311/312 Hazard and Physical Hazards:

Immediate	yes
Delayed	yes
Fire:	no
Pressure:	no
Reactivity:	no

CERCLA/SUPERFUND (40 CFR 117, 302)

Ingredient	RQ (Reportable Quantity)
ferric chloride, solution	1000 pounds, anhydrous basis

RCRA:

If discarded in its purchased form, this product would be a hazardous waste by characteristic. Under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.

This product contains no Class I or Class II Ozone Depleting Chemicals

TSCA:

All compounds contained in this product are in the TSCA inventory

DOT:

Please see Section 14.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

16. OTHER INFORMATION

The following label hazard ratings are recommended for containers of Ferric Chloride, Solution:

(Hazard Index Key: 4 = severe; 3 = serious; 2 = moderate; 1 = slight; 0 = minimal)

NFPA		HMIS	
Health	not rated	Health	3
Flammability	not rated	Flammability	0
Reactivity	not rated	Reactivity	0

For Additional Information:

Contact: MSDS Coordinator - Univar USA

During business hours, Pacific Time - (425) 889-3400

NOTICE

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Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your local Univar USA Sales Office.

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makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar USA's control. Therefore, users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes, and they assume all risks of their use, handling, and disposal of the product or from the publication or use of, or reliance upon, information contained herein. This information relates only to the product designated herein and does not relate to its use in combination with any other material or in any other process.

END OF MSDS



Univar USA Inc Material Safety Data Sheet

MSDS No:

Version No:

Order No:

Univar USA Inc., 17425 NE Union Hill Rd., Redmond WA 98052
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: ALUMINUM SULFATE SOLUTION

DATE: 08/02/10
PAGE: 1 OF 7

SAFETY DATA SHEET

This Safety Data Sheet conforms to ANSI Z400.5, and to the format requirements and the International Chemical Safety Cards of the Global Harmonizing System. THIS SDS COMPLIES WITH 29 CFR 1910.1200 (HAZARD COMMUNICATION STANDARD)
IMPORTANT: Read this SDS before handling & disposing of this product.
Pass this information on to employees, customers, & users of this product.

SECTION 1. IDENTIFICATION OF THE SUBSTANCE OR MIXTURE AND OF THE SUPPLIER

PRODUCT IDENTITY: ALUMINUM SULFATE SOLUTION
SDS NUMBER: CDS1658
NEW MSDS DATE: 08/02/2010
COMPANY IDENTITY: Univar USA Inc.
COMPANY ADDRESS: 17425 NE Union Hill Road
COMPANY CITY: Redmond, WA 98052
COMPANY PHONE: 1-425-889-3400
EMERGENCY PHONES: CHEMTREC: 1-800-424-9300 (USA)
CANUTEC: 1-613-996-6666 (CANADA)

SECTION 2. HAZARDS IDENTIFICATION

CAUTION

RISK STATEMENTS:
R34 Causes burns.

SAFETY STATEMENTS:
S24/25 Avoid contact with skin and eyes.

SEE SECTION 11 FOR OTHER TOXICOLOGICAL INFORMATION (ACUTE & CHRONIC HAZARDS)

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

MATERIAL	CAS#	EINECS#	WT%	TWA (OSHA)	TLV (ACGIH)
Water	7732-18-5	231-791-2	75-85	None Known	None Known
Aluminum Sulfate*	10043-01-3	-	15-25	None Known	None Known

This product contains no EPA Hazardous Air Pollutants (HAP) in amounts > 0.1%.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: ALUMINUM SULFATE SOLUTION

DATE: 08/02/10
PAGE: 2 OF 7

SECTION 4. FIRST AID MEASURES

EYE CONTACT:

For eyes, flush with plenty of water for 15 minutes & get medical attention.

SKIN CONTACT:

In case of contact with skin immediately remove contaminated clothing.
Wash thoroughly with soap & water. Wash contaminated clothing before reuse.

INHALATION:

After high vapor exposure, remove to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, trained personnel should immediately begin artificial respiration. If the heart has stopped, trained personnel should immediately begin cardiopulmonary resuscitation (CPR).

SWALLOWING:

Rinse mouth. GET MEDICAL ATTENTION IMMEDIATELY. Do NOT give liquids to an unconscious or convulsing person.

SECTION 5. FIRE FIGHTING MEASURES

FIRE & EXPLOSION PREVENTIVE MEASURES

Not applicable.

EXTINGUISHING MEDIA

Use appropriate extinguishing media for surrounding fires.

SPECIAL FIRE FIGHTING PROCEDURES

Water spray may be ineffective on fire but can protect fire-fighters & cool closed containers. Use fog nozzles if water is used.
Do not enter confined fire-space without full bunker gear.
(Helmet with face shield, bunker coats, gloves & rubber boots).
Use NIOSH approved positive-pressure self-contained breathing apparatus.

UNUSUAL EXPLOSION AND FIRE PROCEDURES

Noncombustible.
Closed containers may explode if exposed to extreme heat.
Applying to hot surfaces requires special precautions.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: ALUMINUM SULFATE SOLUTION

DATE: 08/02/10
PAGE: 3 OF 7

SECTION 6. ACCIDENTAL RELEASE MEASURES

PERSONAL PROTECTIVE MEASURES:

Keep unprotected personnel away.
Wear appropriate personal protective equipment given in Section 8.

ENVIRONMENTAL PRECAUTIONS:

Keep from entering storm sewers and ditches which lead to waterways.

CONTAINMENT AND CLEAN-UP MEASURES:

Stop spill at source. Dike and contain.
Collect leaking & spilled liquid in sealable containers as far as possible.

SECTION 7. HANDLING AND STORAGE

HANDLING

Wear OSHA Standard goggles or face shield. Consult Safety Equipment Supplier. Wear gloves, apron & footwear impervious to this material. Wash clothing before reuse. To minimize static discharge when transferring, ensure electrical continuity by bonding and grounding all equipment. Use an inlet line diameter of at least 3.5 inches (8.9 centimeters) with a maximum flow rate of 1 meter/second.

STORAGE

Isolate from strong oxidants. Do not store above 49 C/120 F.
Keep container tightly closed & upright when not in use to prevent leakage.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

RESPIRATORY EXPOSURE CONTROLS

A respiratory protection program that meets OSHA 29 CFR 1910.134 and ANSI Z86.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

VENTILATION

LOCAL EXHAUST:	Necessary	MECHANICAL (GENERAL):	Acceptable
SPECIAL:	None	OTHER:	None

Please refer to ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

PERSONAL PROTECTIONS:

Wear OSHA Standard goggles or face shield. Consult Safety Equipment Supplier. Wear gloves, apron & footwear impervious to this material. Wash clothing before reuse.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: ALUMINUM SULFATE SOLUTION

DATE: 08/02/10
PAGE: 4 OF 7

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION (CONTINUED)

WORK & HYGIENIC PRACTICES:

Provide readily accessible eye wash stations & safety showers.
Wash at end of each workshift & before eating, smoking or using the toilet.
Promptly remove clothing that becomes contaminated. Destroy contaminated
leather articles. Launder or discard contaminated clothing.

SECTION 9. PHYSICAL & CHEMICAL PROPERTIES

APPEARANCE:	Liquid, Water-White
ODOR:	None
ODOR THRESHOLD:	Not Available
pH (Neutrality):	2.0
MELTING POINT/FREEZING POINT:	Not Available
BOILING RANGE (IBP, 50%, Dry Point):	100 100 100°C/212 212 212°F(*=End Point)
FLASH POINT (TEST METHOD):	Not Applicable
EVAPORATION RATE (n-BUTYL ACETATE=1):	Not Applicable
FLAMMABILITY CLASSIFICATION:	Non-Combustible
LOWER FLAMMABLE LIMIT IN AIR (% by vol):	Not Applicable
UPPER FLAMMABLE LIMIT IN AIR (% by vol):	Not Available
VAPOR PRESSURE (mm of Hg)@20 C	17.5
VAPOR DENSITY (air=1):	0.670
GRAVITY @ 68/68 F / 20/20 C:	
SPECIFIC GRAVITY (Water=1):	1.242
POUNDS/GALLON:	10.342
WATER SOLUBILITY:	Complete
PARTITION COEFFICIENT (n-Octane/Water):	Not Available
AUTO IGNITION TEMPERATURE:	Not Applicable
DECOMPOSITION TEMPERATURE:	Not Available

* Using California South Coast Air Quality Management District (SCAQMD) Rule 443.1.

SECTION 10. STABILITY & REACTIVITY

STABILITY

Stable under normal conditions.

CONDITIONS TO AVOID

None known

MATERIALS TO AVOID

Isolate from oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

Aluminum Oxide from heating.

HAZARDOUS POLYMERIZATION

Will not occur.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: ALUMINUM SULFATE SOLUTION

DATE: 08/02/10
PAGE: 5 OF 7

SECTION 11. TOXICOLOGICAL INFORMATION

ACUTE HAZARDS

EYE & SKIN CONTACT:

Primary irritation to skin, defatting, dermatitis.
Primary irritation to eyes, redness, tearing, blurred vision.
Liquid can cause eye irritation. Wash thoroughly after handling.

INHALATION:

Anesthetic. Irritates respiratory tract. Acute overexposure
can cause serious nervous system depression. Vapor harmful.

SWALLOWING:

Swallowing can cause abdominal irritation, nausea, vomiting & diarrhea.

SUBCHRONIC HAZARDS/CONDITIONS AGGRAVATED

CONDITIONS AGGRAVATED

CONDITIONS AGGRAVATED:None Known.

CHRONIC HAZARDS

CANCER, REPRODUCTIVE & OTHER CHRONIC HAZARDS:

This product has no carcinogens listed by IARC, NTP, NIOSH,
OSHA or ACGIH, as of this date, greater or equal to 0.1%.

MAMMALIAN TOXICITY INFORMATION

No mammalian information is available on this product.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: ALUMINUM SULFATE SOLUTION

DATE: 08/02/10
PAGE: 6 OF 7

SECTION 12. ECOLOGICAL INFORMATION

AQUATIC ANIMAL INFORMATION:

No aquatic environmental information is available on this product.

MOBILITY IN SOIL

Mobility of this material has not been determined.

DEGRADABILITY

This product is completely biodegradable.

ACCUMULATION

Bioaccumulation of this product has not been determined.

SECTION 13. DISPOSAL CONSIDERATIONS

Processing, use or contamination may change the waste management options. Recycle / dispose of observing national, regional, state, provincial and local health, safety & pollution laws. If in doubt, contact appropriate agencies.

SECTION 14. TRANSPORT INFORMATION

DOT SHIPPING NAME: UN3264, Corrosive liquid, acidic, inorganic, n.o.s.
DRUM LABEL: Corrosive (Class 8)
IATA / ICAO: UN3264, Corrosive liquid, acidic, inorganic, n.o.s.
IMO / IMDG: UN3264, Corrosive liquid, acidic, inorganic, n.o.s.
EMERGENCY RESPONSE GUIDEBOOK NUMBER: 154

SECTION 15. REGULATORY INFORMATION

EPA REGULATION:

SARA SECTION 311/312 HAZARDS: None Known

All components of this product are on the TSCA list.
This material contains no known products restricted under SARA Title III, Section 313 in amounts greater or equal to 1%.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: ALUMINUM SULFATE SOLUTION

DATE: 08/02/10
PAGE: 7 OF 7

SECTION 15. REGULATORY INFORMATION (CONTINUED)

> 25000 LB / 11364 KG OF THIS PRODUCT IN 1 CONTAINER EXCEEDS THE "RQ" OF ALUMINUM SULFATE.

Any release equal to or exceeding the RQ must be reported to the National Response Center (800-424-8802) and appropriate state and local regulatory agencies as described in 40 CFR 302.6 and 40 CFR 355.40 respectively. Failure to report may result in substantial civil and criminal penalties. State & local regulations may be more restrictive than federal regulations.

STATE REGULATIONS:

CALIFORNIA PROPOSITION 65: This product contains no chemicals known to the State of California to cause cancer & reproductive toxicity.

INTERNATIONAL REGULATIONS

The components of this product are listed on the chemical inventories of the following countries:
Australia, Canada, China, Europe (EINECS), Japan, Korea, United Kingdom.

CANADA: WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)
D2B: Irritating to skin / eyes.

SECTION 16. OTHER INFORMATION

HAZARD RATINGS:

HEALTH (NFPA): 2, HEALTH (HMIS): 2, FLAMMABILITY: 0, REACTIVITY: 0
(Personal Protection Rating to be supplied by user based on use conditions.)
This information is intended solely for the use of individuals trained in the NFPA & HMIS hazard rating systems.

EMPLOYEE TRAINING

See Section 2 for Risk & Safety Statements. Employees should be made aware of all hazards of this material (as stated in this SDS) before handling it.

Univar USA Inc Material Safety Data Sheet

For Additional Information contact MSDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process



Univar USA Inc Safety Data Sheet

SDS No:

Version No:

Order No:

3075 Highland Pkwy, Ste 200, Downers Grove, IL 60515
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: BLEND SODIUM SULFIDE 5-20% SOLUTION

SDS DATE: 05/06/2014
REPLACES: 10/14/2009

SAFETY DATA SHEET

This Safety Data Sheet conforms to ANSI Z400.5, and to the format requirements of the Global Harmonizing System.
THIS SDS COMPLIES WITH 29 CFR 1910.1200 (HAZARD COMMUNICATION STANDARD)
IMPORTANT: Read this SDS before handling & disposing of this product.
Pass this information on to employees, customers, & users of this product.

SECTION 1. IDENTIFICATION OF THE SUBSTANCE OR MIXTURE AND OF THE SUPPLIER

PRODUCT IDENTITY: BLEND SODIUM SULFIDE 5-20% SOLUTION
SYNONYM: Sodium Sulfide Hydrated Solution
PRODUCT USES: Chemical Processing
SDS NUMBER: CDS-1363
COMPANY IDENTITY: Univar
COMPANY ADDRESS: 17425 NE Union Hill Road
COMPANY CITY: Redmond, WA 98052
COMPANY PHONE: 1-425-889-3400
EMERGENCY PHONES: CHEMTREC: 1-800-424-9300 (USA)
CANUTEC: 1-613-996-6666 (CANADA)

SECTION 2. HAZARDS IDENTIFICATION

DANGER!!!

2.1 HAZARD STATEMENTS: (CAT = Hazard Category)

(H200s) PHYSICAL: Corrosive To Metals:
H290 MAY BE CORROSIVE TO METALS.(CAT:1)
(H300s) HEALTH: Skin Corrosion/Irritation:
H314 CAUSES SEVERE SKIN BURNS AND EYE DAMAGE.(CAT:1)
(H300s) HEALTH: Acute Toxicity, Inhalation:
H332 HARMFUL IF INHALED.(CAT:4)



2.2 PRECAUTIONARY STATEMENTS:

P100s = General, P200s = Prevention, P300s = Response, P400s = Storage, P500s = Disposal

P234 Keep only in original container.
P260 Do not breathe dust/fume/gas/mist/vapors/spray.
P262 Do not get in eyes, on skin, or on clothing.
P264 Wash hands thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P301+330+331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303+361+353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse SKIN with water/shower.
P304+340 IF INHALED: Remove victim to fresh air and Keep at rest in a position comfortable for breathing.
P305+351+338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 Immediately call a POISON CENTER or doctor/physician.
P363 Wash contaminated clothing before reuse.
P390 Absorb spillage to prevent material damage.
P404 Store in a closed container.
P405 Store locked up.
P501 Dispose of contents/container to appropriate waste site or reclaimer in accordance with local and national regulations.

SEE SECTIONS 8, 11 & 12 FOR TOXICOLOGICAL INFORMATION.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: BLEND SODIUM SULFIDE 5-20% SOLUTION

SDS DATE: 05/06/2014
REPLACES: 10/14/2009

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

MATERIAL	CAS#	EINECS#	WT %
Water	7732-18-5	231-791-2	85-95
Sodium Sulfide	1313-82-2	-	3-15
Sodium Carbonate	497-19-8	-	0- 1
Sodium Hydrogen Sulfide	16721-80-5	-	0- 1

TRACE COMPONENTS: Trace ingredients (if any) are present in < 1% concentration, (< 0.1% for potential carcinogens, reproductive toxins, respiratory tract mutagens, and sensitizers). None of the trace ingredients contribute significant additional hazards at the concentrations that may be present in this product. All pertinent hazard information has been provided in this document, per the requirements of the Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalents, and Canadian Hazardous Materials Identification System Standard (CPR 4).

SECTION 4. FIRST AID MEASURES

- 4.1 MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE & CHRONIC:
See Section 11 for Symptoms/Effects (acute & chronic).
- 4.2 EYE CONTACT:
For eyes, flush with plenty of water for 15 minutes & get immediate medical attention.
- 4.3 SKIN CONTACT:
In case of contact with skin immediately remove contaminated clothing.
Wash thoroughly with soap & water. Get medical attention if symptoms develop. Wash contaminated clothing before reuse.
- 4.4 INHALATION:
After high vapor exposure, remove to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, trained personnel should immediately begin artificial respiration. If the heart has stopped, trained personnel should immediately begin cardiopulmonary resuscitation (CPR).
- 4.5 SWALLOWING:
Rinse mouth. GET MEDICAL ATTENTION IMMEDIATELY. Do NOT give liquids to an unconscious or convulsing person.

SECTION 5. FIRE FIGHTING MEASURES

- 5.1 FIRE & EXPLOSION PREVENTIVE MEASURES:
Isolate from oxidizers, extreme heat and open flame.
- 5.2 SUITABLE (& UNSUITABLE) EXTINGUISHING MEDIA:
Use dry powder, foam, carbon dioxide, or water spray extinguishing media.
Do not use water jet.
- 5.3 SPECIAL PROTECTIVE EQUIPMENT & PRECAUTIONS FOR FIRE FIGHTERS:
Water spray may be ineffective on fire but can protect fire-fighters & cool closed containers. Use fog nozzles if water is used.
Do not enter confined fire-space without full bunker gear.
(Helmet with face shield, bunker coats, gloves & rubber boots).
- 5.4 SPECIFIC HAZARDS OF CHEMICAL & HAZARDOUS COMBUSTION PRODUCTS:
Noncombustible.
Closed containers may explode if exposed to extreme heat.
Applying to hot surfaces requires special precautions.
Contact with acids will liberate flammable & poisonous Hydrogen Sulfide gas.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: BLEND SODIUM SULFIDE 5-20% SOLUTION

SDS DATE: 05/06/2014
REPLACES: 10/14/2009

SECTION 6. ACCIDENTAL RELEASE MEASURES

- 6.1 PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT & EMERGENCY PROCEDURES:
Keep unprotected personnel away. Wear appropriate personal protective equipment given in Section 8.
- 6.2 ENVIRONMENTAL PRECAUTIONS:
Keep from entering storm sewers and ditches which lead to waterways.
- 6.3 METHODS & MATERIAL FOR CONTAINMENT & CLEAN-UP:
Stop spill at source. Dike and contain.
Collect leaking & spilled liquid in sealable containers as far as possible.

SECTION 7. HANDLING AND STORAGE

- 7.1 PRECAUTIONS FOR SAFE HANDLING:
Use only with adequate ventilation. Wear OSHA Standard goggles or face shield. Consult Safety Equipment Supplier. Wear goggles, face shield, gloves, apron & footwear impervious to material. Wash clothing before reuse.
- 7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES:
Isolate from strong oxidants. Do not store above 49 C/120 F.
Keep container tightly closed & upright when not in use to prevent leakage.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 EXPOSURE LIMITS:

MATERIAL	CAS#	EINECS#	TWA (OSHA)	TLV (ACGIH)
Water	7732-18-5	231-791-2	None Known	None Known
Sodium Sulfide	1313-84-4	-	None Known	None Known
Sodium Carbonate	497-19-8	-	None Known	None Known
Sodium Hydrogen Sulfide	16721-80-5	-	None Known	None Known

This product contains no EPA Hazardous Air Pollutants (HAP) in amounts > 0.1%.

8.2 APPROPRIATE ENGINEERING CONTROLS:

RESPIRATORY EXPOSURE CONTROLS

A respiratory protection program that meets OSHA 29 CFR 1910.134 and ANSI Z86.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

VENTILATION

LOCAL EXHAUST: Necessary
SPECIAL: None
MECHANICAL (GENERAL): Acceptable
OTHER: None
Please refer to ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

8.3 INDIVIDUAL PROTECTION MEASURES, SUCH AS PERSONAL PROTECTIVE EQUIPMENT:

PERSONAL PROTECTIONS:

Wear OSHA Standard goggles or face shield. Consult Safety Equipment Supplier. Wear goggles, face shield, gloves, apron & footwear impervious to material. Wash clothing before reuse.

WORK & HYGIENIC PRACTICES:

Provide readily accessible eye wash stations & safety showers.
Wash at end of each workshift & before eating, smoking or using the toilet.
Promptly remove clothing that becomes contaminated. Destroy contaminated leather articles. Launder or discard contaminated clothing.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: BLEND SODIUM SULFIDE 5-20% SOLUTION

SDS DATE: 05/06/2014
REPLACES: 10/14/2009

SECTION 9. PHYSICAL & CHEMICAL PROPERTIES

APPEARANCE: Liquid, Clear, Water-White
ODOR: Odor of rotten eggs (Hydrogen Sulfide)
ODOR THRESHOLD: Not Available
pH (Neutrality): Not Available
MELTING POINT/FREEZING POINT: Not Available
BOILING RANGE (IBP,50%,Dry Point): > 100 C / > 212 F
FLASH POINT (TEST METHOD): Not Applicable
EVAPORATION RATE (n-Butyl Acetate=1): Not Applicable
FLAMMABILITY CLASSIFICATION: Non-Combustible
LOWER FLAMMABLE LIMIT IN AIR (% by vol): Not Applicable
UPPER FLAMMABLE LIMIT IN AIR (% by vol): Not Available
VAPOR PRESSURE (mm of Hg)@20 C 17.5
VAPOR DENSITY (air=1): 0.670
GRAVITY @ 68/68 F / 20/20 C:
DENSITY: 1.088
SPECIFIC GRAVITY (Water=1): 1.098
POUNDS/GALLON: 9.15
WATER SOLUBILITY: Appreciable
PARTITION COEFFICIENT (n-Octane/Water): Not Available
AUTO IGNITION TEMPERATURE: Not Applicable
DECOMPOSITION TEMPERATURE: Not Available
VOCs (>0.044 Lbs/Sq In) : 0.0 Vol% /0.0 g/L / 0.000 Lbs/Gal
TOTAL VOC'S (TVOC)*: 0.0 Vol% /0.0 g/L / 0.000 Lbs/Gal
NONEXEMPT VOC'S (CVOC)*: 0.0 Vol% /0.0 g/L / 0.000 Lbs/Gal
HAZARDOUS AIR POLLUTANTS (HAPS): 0.0 Wt% /0.0 g/L / 0.000 Lbs/Gal
NONEXEMPT VOC PARTIAL PRESSURE (mm of Hg @ 20 C) 0.0
VISCOSITY @ 20 C (ASTM D445): Not Available
* Using CARB (California Air Resources Board Rules).

SECTION 10. STABILITY & REACTIVITY

- 10.1 REACTIVITY & CHEMICAL STABILITY:
Stable under normal conditions, no hazardous reactions when kept from incompatibles.
Darkens upon exposure to light or air.
- 10.2 POSSIBILITY OF HAZARDOUS REACTIONS & CONDITIONS TO AVOID:
Isolate from extreme heat and open flame.
- 10.3 INCOMPATIBLE MATERIALS:
Isolate from oxidizers.
- 10.4 HAZARDOUS DECOMPOSITION PRODUCTS:
Sodium Oxide, Sodium Hydroxide, and Hydrogen Sulfide from heating.
- 10.5 HAZARDOUS POLYMERIZATION:
Will not occur.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: BLEND SODIUM SULFIDE 5-20% SOLUTION

SDS DATE: 05/06/2014
REPLACES: 10/14/2009

SECTION 11. TOXICOLOGICAL INFORMATION

11.1 ACUTE HAZARDS

11.11 EYE & SKIN CONTACT:

Primary irritation to skin, defatting, dermatitis.
Primary irritation to eyes, redness, tearing, blurred vision.
Liquid causes eye irritation and possible burns. Wash thoroughly after handling.

11.12 INHALATION:

Anesthetic. Irritates respiratory tract. Acute overexposure can cause serious nervous system depression. Vapor harmful.

11.13 SWALLOWING:

Swallowing can cause abdominal irritation, nausea, vomiting & diarrhea.

11.2 SUBCHRONIC HAZARDS/CONDITIONS AGGRAVATED

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

Pre-existing disorders of any target organs mentioned in this SDS can be aggravated by over-exposure by routes of entry to components of this product. Persons with these disorders should avoid use of this product.

11.3 CHRONIC HAZARDS

11.31 CANCER, REPRODUCTIVE & OTHER CHRONIC HAZARDS:

This product has no carcinogens listed by IARC, NTP, NIOSH, OSHA or ACGIH, as of this date, greater or equal to 0.1%.

11.32 TARGET ORGANS: May cause damage to target organs, based on animal data.

11.33 IRRITANCY: Irritating to contaminated tissue.

11.34 SENSITIZATION: No component is known as a sensitizer.

11.35 MUTAGENICITY: No known reports of mutagenic effects in humans.

11.36 EMBRYOTOXICITY: No known reports of embryotoxic effects in humans.

11.37 TERATOGENICITY: No known reports of teratogenic effects in humans.

11.38 REPRODUCTIVE TOXICITY: No known reports of reproductive effects in humans.

A MUTAGEN is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate across generational lines. An EMBRYOTOXIN is a chemical which causes damage to a developing embryo (such as: within the first 8 weeks of pregnancy in humans), but the damage does not propagate across generational lines. A TERATOGEN is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A REPRODUCTIVE TOXIN is any substance which interferes in any way with the reproductive process.

11.4 MAMMALIAN TOXICITY INFORMATION

No mammalian information is available on this product.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: BLEND SODIUM SULFIDE 5-20% SOLUTION

SDS DATE: 05/06/2014
REPLACES: 10/14/2009

SECTION 12. ECOLOGICAL INFORMATION

12.1 ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

12.2 EFFECT OF MATERIAL ON PLANTS AND ANIMALS:

This product may be harmful or fatal to plant and animal life if released into the environment. Refer to Section 11 (Toxicological Information) for further data on the effects of this product's components on test animals.

12.3 EFFECT OF MATERIAL ON AQUATIC LIFE:

No aquatic environmental information is available on this product.

12.4 MOBILITY IN SOIL

Mobility of this material has not been determined.

12.5 DEGRADABILITY

This product is completely biodegradable.

12.6 ACCUMULATION

Bioaccumulation of this product has not been determined.

SECTION 13. DISPOSAL CONSIDERATIONS

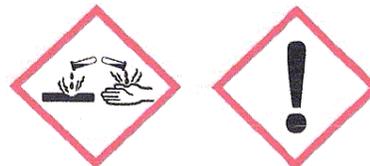
The generation of waste should be avoided or minimized wherever possible. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers and liners may retain some product residues. Vapor from some product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Processing, use or contamination may change the waste disposal requirements. Do not dispose of on land, in surface waters, or in storm drains. Waste should be recycled or disposed of in accordance with regulations. Large amounts should be collected for reuse or consigned to licensed hazardous waste haulers for disposal. **ALL DISPOSAL MUST BE IN ACCORDANCE WITH ALL FEDERAL, STATE, PROVINCIAL, AND LOCAL REGULATIONS. IF IN DOUBT, CONTACT PROPER AGENCIES.**

SECTION 14. TRANSPORT INFORMATION

MARINE POLLUTANT: No
DOT/TDG SHIP NAME: UN1849, Sodium sulfide, hydrated, solution, 8, PG-II
DRUM LABEL: Corrosive (8)
IATA / ICAO: UN1849, Sodium sulfide, hydrated, solution, 8, PG-II
IMO / IMDG: UN1849, Sodium sulfide, hydrated, solution, 8, PG-II
EMERGENCY RESPONSE GUIDEBOOK NUMBER: 153

SECTION 15. REGULATORY INFORMATION

15.1 EPA REGULATION:
SARA SECTION 311/312 HAZARDS: Acute Health



All components of this product are on the TSCA list.
SARA Title III Section 313 Supplier Notification
This product contains the indicated <*> toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning & Community Right-To-Know Act of 1986 & of 40 CFR 372. This information must be included in all MSDSs that are copied and distributed for this material.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: BLEND SODIUM SULFIDE 5-20% SOLUTION

SDS DATE: 05/06/2014
REPLACES: 10/14/2009

SECTION 15. REGULATORY INFORMATION (CONTINUED)

15.2 STATE REGULATIONS:

THIS PRODUCT MEETS REQUIREMENTS OF SOUTHERN
CALIFORNIA AQMD RULE 443.1 & SIMILAR REGULATIONS

CALIFORNIA SAFE DRINKING WATER & TOXIC ENFORCEMENT ACT (PROPOSITION 65):

This product contains no chemicals known to the State of California
to cause cancer or reproductive toxicity.

15.3 INTERNATIONAL REGULATIONS

The identified components of this product are listed on the chemical inventories
of the following countries:

Australia (AICS), Canada (DSL or NDSL), China (IECSC), Europe (EINECS, ELINCS),
Japan (METI/CSCL, MHLW/ISHL), South Korea (KECI), New Zealand (NZIoC),
Philippines (PICCS), Switzerland (SWISS), Taiwan (NECSI), USA (TSCA).

15.4 CANADA: WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)

D2B: Irritating to skin / eyes.

This product has been classified in accordance with hazard criteria of the Controlled
Products Regulations (CPR) and the SDS contains all information required by the CPR.

SECTION 16. OTHER INFORMATION

16.1 HAZARD RATINGS:

HEALTH (NFPA): 2, HEALTH (HMIS): 2, FLAMMABILITY: 0, PHYSICAL HAZARD: 1
(Personal Protection Rating to be supplied by user based on use conditions.)
This information is intended solely for the use of individuals
trained in the NFPA & HMIS hazard rating systems.

16.2 EMPLOYEE TRAINING

See Section 2 for Risk & Safety Statements. Employees should be made aware
of all hazards of this material (as stated in this SDS) before handling it.

16.3 SDS DATE: 05/06/2014

Univar USA Inc Safety Data Sheet

For Additional Information contact SDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this SDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET
Material Name: AP-210

SECTION 1 – GENERAL INFORMATION

Manufacturer/Supplier's Name: ADEGA CHEMICAL
25411 NE 53rd Street
Vancouver, Wa 98682

PRODUCT AND TECHNICAL INFORMATION NUMBER: (949) 275-7208

SECTION 2 – COMPOSITION / INFORMATION ON INGREDIENTS

IDENTIFICATION OF THE PREPARATION: Anionic Water-Soluble Polymer
(polyacrylamide; CAS No. 9003-05-8)

SECTION 3 – HAZARDS IDENTIFICATION

Aqueous solutions or powders that become wet render surfaces extremely slippery

SECTION 4 – FIRST AID MEASURES

INHALATION: Move to fresh air.

SKIN CONTACT: Wash with water and soap as a precaution. In case of persistent skin irritation, consult physician.

EYE CONTACT: Rinse thoroughly with plenty of water, also under the eyelids. In case of persistent eye irritation, consult a physician.

INGESTION: The product is not considered toxic based on studies on laboratory animals.

SECTION 5 – FIRE-FIGHTING MEASURES

SUITABLE EXTINGUISHING MEDIA: Water, water spray, foam, carbon dioxide (CO₂), dry powder.

SPECIAL FIRE-FIGHTING PRECAUTIONS: Aqueous solutions or powders that become wet render surfaces extremely slippery.

PROTECTIVE EQUIPMENT FOR FIREFIGHTERS: No special protective equipment required.

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET
Material Name: AP-210

SECTION 6 – ACCIDENTAL RELEASE MEASURES

- PERSONAL PRECAUTIONS:** No special precautions required.
- ENVIRONMENTAL PRECAUTIONS:** Do not contaminate water
- METHODS FOR CLEANING UP:** Do not flush with water. Clean Up promptly by sweeping or vacuum. Keep in suitable and closed containers for disposal. After cleaning, flush away traces with water.

SECTION 7 – HANDLING AND STORAGE

- HANDLING:** Avoid contact with skin and eyes. Avoid dust formation. Do not breathe dust. Wash hands before breaks and at the end of workday.
- STORAGE:** Keep in a dry, cool place (0-35°C).

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

- ENGINEERING CONTROLS:** Use local exhaust if dusting occurs. Natural ventilation is adequate in absence of dusts.

PERSONAL PROTECTION EQUIPMENT

- RESPIRATORY PROTECTION:** Dust safety masks are recommended where concentration of total dust is more than 10 mg/m³
- HAND PROTECTION:** Rubber gloves
- EYE PROTECTION:** Safety glasses with side-shields. Do not wear contact lenses
- SKIN PROTECTION:** Chemical resistant apron or protective suit if splashing or contact with solution is likely.
- HYGIENE MEASURES:** Wash hands before breaks and at the end of the workday. Handle in accordance with good industrial hygiene and safety practice.

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET
Material Name: AP-210

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

FORM:	Granular solid
COLOR:	White
ODOR:	None
PH:	5-9@5g/l
MELTING POINT (C):	Not Applicable
FLASH POINT(C):	Not Applicable
AUTOIGNITION TEMPERATURE (C):	Not Applicable
VAPOUR PRESSURE (MM HG):	Not Applicable
BULK DENSITY:	0.6 to 0.9
MAX CONCENTRATION:	10 g/L
VISCOSITY (MPA S):	@ 20 °C; 1 g/L ≈ 170 cps; 5 g/L ≈ 1200 cps

SECTION 10 – STABILITY AND REACTIVITY

STABILITY: Product is stable. No hazardous polymerization will occur

CONDITIONS TO AVOID: Oxidizing agents may cause exothermic reactions.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition may produce nitrogen oxides (NO_x), carbon oxides C(O_x)

SECTION 11 – TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

ORAL:	LD50/Oral/Rat>5000mg/kg
DERMAL:	LD50/Oral/Rat>5000mg/kg
INHALATION:	The product is not expected to be toxic by inhalation.

IRRITATION

SKIN:	Not irritating
EYES:	Not irritating
RESPIRATORY SYSTEM:	Not a respiratory irritant
SENSITIZATION:	No sensitizing
CARCINOGENICITY:	Not carcinogenic
CHRONIC TOXICITY:	No Chronic effects

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET
Material Name: AP-210

SECTION 12 – ECOLOGICAL INFORMATION

FISH: LC50/Fathead minnow/96 hr>100 mg/L (OECD 203)

ALGAE: LC50/Scenedesmus subspicatus/72hr>100 mg/L (OECD 201)

DAPHNIDS: EC50/C. Dubia/48 hr>100 mg/L (OECD 202)

BIOACCUMULATION: Does not bioaccumulate.

PERSISTENCE / DEGRADABILITY: Not readily biodegradable.

SECTION 13 – DISPOSAL CONSIDERATIONS

WASTE FROM RESIDUES / UNUSED PRODUCTS: In accordance with Federal, State, and Local Regulations.

CONTAMINATED PACKAGING: Rinse empty containers with water and use the rinse water to prepare the working solution. Can be landfilled or incinerated, when in compliance with local regulations.

SECTION 14 – TRANSPORT INFORMATION

NOT REGULATED BY D.O.T.

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET
Material Name: AP-210

SECTION 15 – REGULATORY INFORMATION

**ALL COMPONENTS OF THIS PRODUCT ARE ON THE
TSCA AND DSL INVENTORIES**

RCRA STATUS: Not a hazardous waste.

HAZARDOUS WASTE NUMBER: Not Applicable

REPORTABLE QUANTITY (40 CFR 302): Not Applicable

THRESHOLD PLANNING QUANTITY (40 CFR 355): Not Applicable

CALIFORNIA PROPOSITION 65 INFORMATION:

The following statement is made in order to comply with the ca safe drinking water and toxic enforcement act of 1986: this product contains a chemical known to the state of california to cause cancer: residual acrylamide

HMIS & NFPA RATINGS:

	HMIS	NFPA
HEALTH	1	1
FLAMMABILITY:	1	1
REACTIVITY:	0	0

SECTION 16 – OTHER INFORMATION

PERSON TO CONTACT: Regulatory Affairs Manager

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of it's publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release, and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process unless specified in the text.

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET
Material Name: CP-120

MATERIAL SAFETY DATA SHEET

Manufacturer/Supplier's Name: ADEGA CHEMICAL
27917 Paseo El Concho
San Juan Capistrano, CA 92675

PRODUCT AND TECHNICAL INFORMATION NUMBER: (949) 275-7208

NFPA RATING: HEALTH: 2 FLAMMABILITY: 1 INSTABILITY: 0

HMIS RATING: HEALTH: 2 FLAMMABILITY: 1 PHYSICAL HAZARD: 0
PERSONAL PROTECTION: X

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

CHEMICAL FAMILY: Copolymer of a quaternary acrylate salt and acrylamide.
INTENDED USE: Flocculant

EMERGENCY 24-HOUR HEALTH/ENVIRONMENTAL PHONE
1-800-973-1138

SECTION 2 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

SIGNAL WORD: CAUTION!

PHYSICAL FORM: Granular powder

COLOR: White

ODOR: Little or no

HEALTH: Contact causes eye irritation. Inhalation of dust may cause respiratory tract irritation.

PHYSICAL HAZARDS: Slip hazard when wet, refer to MSDS Section 7 for dust explosion information.

ENVIRONMENTAL: Releases to the environment are to be avoided

OSHA HAZARDOUS SUBSTANCE: This material is classified as hazardous under OSHA regulations.

PRIMARY ROUTE(S) OF ENTRY: Eyes, skin, inhalation, ingestion

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET
Material Name: CP-120

SECTION 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS

COMPONENTS	CAS NUMBER	WEIGHT %
Ethanaminium, N, N, N-trimethyl-2-[(1-oxo-2-propenyl)oxy]-, chloride, polymer with 2-propenamide	69418-26-4	87.4
Hexanedioic acid	124-04-9	4.6

SECTION 4 – FIRST AID MEASURES

- EYES:** Immediately flush the eye(s) with lukewarm, gently flowing water for 15 minutes or until the chemical is removed. Get medical attention.
- SKIN:** Wash off immediately with soap and plenty of water. Get medical attention if irritation occurs. If clothing is contaminated, remove and launder before reuse.
- INHALATION:** Remove to fresh air, if not breathing give artificial respiration. If breathing is difficult give oxygen and get immediate medical attention.
- INGESTION:** Do not induce vomiting. If vomiting occurs naturally, have casualty lean forward to reduce the risk of aspiration. Seek medical attention immediately.

SECTION 5 – FIRE FIGHTING MEASURES

- FIRE FIGHTING MEASURES:** Standard procedure for chemical fires.
- SUITABLE EXTINGUISHING MEDIA:** Carbon dioxide, dry chemical or foam.
- UNSUITABLE EXTINGUISHING MEDIA:** The product becomes slippery when wet. If water is used, restrict pedestrian and vehicular traffic in areas where slip hazard may exist.
- FIRE FIGHTING EQUIPMENT:** Wear self-contained breathing apparatus and protective suit.
- UNUSUAL HAZARDS:** Dust in sufficient concentration can result in an explosive mixture in air. Handle to minimize dusting and eliminate open flame and other sources of ignition.

ADEGA CHEMICAL COMPANY

MATERIAL SAFETY DATA SHEET

Material Name: CP-120

HAZARDOUS COMBUSTION PRODUCTS: Burning may produce oxides of carbon or nitrogen.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

CLEANUP INSTRUCTIONS: Sweep up and shovel into suitable containers for disposal. Avoid dust formation. Wear suitable protective equipment. Should not be released into the environment.

SECTION 7 – HANDLING AND STORAGE

HANDLING: As with all industrial chemicals, use good industrial practices when handling. Avoid eye, skin, and clothing contact. Do not inhale, taste, or swallow. Use only with adequate ventilation.

STORAGE: Keep containers tightly closed in a cool, well-ventilated place. Avoid wet, damp or humid conditions, temperature extremes and ignition sources.

EXPLOSION HAZARDS: Avoid creating dusty conditions. Risk of explosion if an air-dust mixture forms.

FOR INDUSTRIAL USE ONLY

SECTION 8 – EXPOSURE CONTROLS. I PERSONAL PROTECTION

EXPOSURE GUIDELINES:

Components	OSHA PEL	OSHA STEL	ACGIH TWA	ACGIH STEL	Ciba/Manufacturer IEL:
Hexanedioic Acid 124-04-9			5 mg/m ³		

Table Footnote: Blank cells in the above table indicate no data available

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE PROTECTION: Wear safety glasses or goggles to protect against dust particles.

SKIN PROTECTION: Wear chemical restraint gloves and protective clothing.

RESPIRATORY PROTECTION: Use nose approved respirator as needed to mitigate exposure.

ADEGA CHEMICAL COMPANY

MATERIAL SAFETY DATA SHEET

Material Name: CP-120

ENGINEERING CONTROLS: Work in well ventilated areas. Do not breathe dust.
Local exhaust / ventilation recommended.

OTHER PROTECTIVE EQUIPMENT: Eye wash station and safety shower should be available in immediate work area. Select additional protective equipment based upon potential for exposure.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL FORM: Granular powder
COLOR: White
ODOR: Little or no
FREEZING/MELTING POINT: Not determined
SOLUBILITY IN WATER: Soluble, solubility limited by viscosity
VAPOR DENSITY: Not applicable
VAPOR PRESSURE: Not applicable
DENSITY: Not determined
SPECIFIC GRAVITY: 0.8-1
PH: -3.3 (1% solution)
PERCENT VOLATILE: Negligible
VOC: 0 % (EPA method 24/24A)
PARTITION COEFFICIENT (OCTANOL/WATER): Not determined
DECOMPOSITION TEMPERATURE: Not determined
FLAMMABILITY LIMITS IN AIR:
FLASH POINT: Not applicable
TEST METHOD (FOR FLASH POINT): Not applicable

SECTION 10 – STABILITY AND REACTIVITY

STABILITY: Stable

CONDITIONS TO AVOID: Avoid high temperatures. Avoid wet and humid conditions.
Avoid static discharges and sources of ignition.

INCOMPATIBILITY: Strong oxidizing agents. (may degrade polymer)

HAZARDOUS DECOMPOSITION PRODUCTS: No decomposition expected under normal storage conditions.

POSSIBILITY OF HAZARDOUS REACTIONS:
Product has a high minimum ignition energy; however, dust may be ignited under some conditions.

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET
Material Name: CP-120

SECTION 11 – TOXICOLOGICAL INFORMATION

ACUTE ORAL TOXICITY: Not determined

ACUTE DERMAL TOXICITY: Not determined

ACUTE INHALATION TOXICITY: Not determined

EYE IRRITATION: Not determined

SKIN IRRITATION: Not determined

SKIN SENSITIZATION: Not determined

CARCINOGENICITY (IARC;NTP;OSHA;ACGIH):

None of the components in this product at concentrations greater than 0.1% are listed by IARC; NTP, OSHA or ACGIH as a carcinogen.

CARCINOGENICITY STUDIES: Not listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

MUTAGENICITY: Not determined

REPRODUCTION TOXICITY: Not determined

TERATOGENICITY: Not determined

NEUROTOXICITY: Not determined

SUBACUTE TOXICITY: Not determined

SUBCHRONIC TOXICITY: Not determined

CHRONIC TOXICITY: Not determined

**ABSORPTION / DISTRIBUTION 1
EXCRETION / METABOLISM:**

Not determined

ADDICTION INFORMATION: Not determined

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET
Material Name: CP-120

SECTION 12 – ECOLOGICAL INFORMATION

TOXICITY TO FISH:	Not determined
TOXICITY TO INVERTEBRATES:	LC50: 48 hour (Daphnia magna) > 100 mg/L (under static conditions in the presence of humic acid)
TOXICITY TO ALGAE:	Not determined
TOXICITY TO SEWAGE BACTERIA:	Not determined
ACTIVATED SLUDGE RESPIRATION INHIBITION TEST:	Not determined
BIOCHEMICAL OXYGEN DEMAND (BOD):	Not determined
CHEMICAL OXYGEN DEMAND (COD):	Not determined
TOTAL OXYGEN DEMAND (TOD):	Not determined
BIODEGRADABILITY:	Not determined
BIOACCUMULATION:	Not determined

ADDITIONAL ENVIRONMENTAL DATA:

This product contains polymer(s) that may be toxic to aquatic organisms when tested in pure (distilled) water. Toxicity is greatly reduced by particles in natural water.

SECTION 13 – DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Dispose in accordance with local, state, provincial and federal regulations.

SECTION 14 – TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT):	Not regulated for this mode of transport
INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG):	Not regulated for this mode of transport

ADEGA CHEMICAL COMPANY
MATERIAL SAFETY DATA SHEET
Material Name: CP-120

INTERNATIONAL AIR TRANSPORTATION AUTHORITY: Not regulated for this mode of transport

SECTION 15 – REGULATORY INFORMATION

FEDERAL REGULATIONS

OSHA HAZARDOUS SUBSTANCE: This material is classified as hazardous under OSHA regulations

CLEAN AIR ACT – HAZARDOUS AIR POLLUTANTS (HAP):
This product contains the following Hazardous Air Pollutants (HAP) as defined by the U.S. Clean Air Act Section 112 (40 CFF 61).

Components	CAA Section 112 Statutory Hazardous Air Pollutants
2-propenamide 79-06-1 (0-0.09 %)	Listed.

CLEAN AIR ACT – VOLATILE ORGANIC COMPOUNDS:
This product contains the following SOCI Intermediate or Final Volatile Organic Compounds (VOC), as defined by the U.S. Clean Air Act Section 111 – (40 CFR 60.489).

Components	CAA Section 111 Volatile Organic Compounds
Hexanedioic acid 124-04-9	Listed.
2-propenamide 79-06-1	Listed

CLEAN AIR ACT – OZONE DEPLETING SUBSTANCES (ODS):
This product neither contains, nor was manufactured with a Class I or Class II ozone depleting substance (ODS), as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App. A+B).

CLEAN WATER ACT – PRIORITY POLLUTANTS (PP):
This product does not contain any priority pollutants listed under the U.S. Clean Water Act section 307 (2)(1) Priority Pollutant List (40 CFR 401.15).

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA):
Not a hazardous waste under RCRA (40 CFR 261.21).

ADEGA CHEMICAL COMPANY

MATERIAL SAFETY DATA SHEET

Material Name: CP-120

SARA SECTION 301 EXTREMELY HAZARDOUS SUBSTANCES (EHS):

This product contains the following component(s) regulated under Section 302 (40 CFR 355) as Extremely Hazardous Substances.

Components	Section 302 Extremely Hazardous Substances (EHS)
2-propenamide 79-06-1 (0-0.09 %)	Listed.

SARA SECTION 304 CERCLA HAZARDOUS SUBSTANCES:

This product contains the following component(s) regulated under Section 304 (40 CFR 203) as hazardous chemical for emergency release notification ("CERCLA" list).

Components	Section 304 CERCLA Hazardous Substances	CERCLA Reportable Quantity
Hexanedioic acid 124-04-9 (4.6%)	Listed	5000 LBS
2-propenamide 79-06-1 (0-0.09%)	Listed	5000 LBS

SARA SECTION 311/312 HAZARD COMMUNICATION STANDARD (HCS):

This product is regulated under Section 311/312 HCS (40 CFR 370). It's hazard(s): Acute (immediate) health hazard.

SARA SECTION 313 TOXIC CHEMICAL LIST (TCL):

This product does not contain any components reportable under Sec 313 (40 CFR 372).

TSCA SECTION 8(B) INVENTORY STATUS:

All component(s) comprising this product are either exempt or listed on the TSCA inventory.

TSCA SECTION 5(E) CONSENT ORDERS:

This product is not subject to a Section 5(e) consent order.

TSCA SIGNIFICANT NEW USE RULE (SNUR):

This product is not subject to a significant new use rule (SNUR).

TSCA SECTION 5(F): This product is not subject to a section 5(f)/6(a) rule.

TSCA SECTION 12(B) EXPORT NOTIFICATION:

This product does not contain any component(s) that are subject to a Section 12(b) export notification.

ADEGA CHEMICAL COMPANY

MATERIAL SAFETY DATA SHEET

Material Name: CP-120

STATE REGULATIONS

CALIFORNIA PROPOSITION 65:

This product contains the following component(s) currently on the California list of Known Carcinogens and Reproductive Toxins.

Components	California Proposition 65
2-propenamide 79-06-1	Carcinogenic.

PENNSYLVANIA RIGHT-TO-KNOW:

This product contains the following component(s) which are subject to Pennsylvania Right-To-Know disclosure requirement.

Components	CAS Number	Pennsylvania Right-to-Know
Ethanaminium, N, N, N-trimethyl-2-[(1-oxo-2-propenyl)oxy] -, chloride, polymer with 2-propenamide	69478-26-4	Not Listed.
Hexanedioic acid	124-04-9	Listed. Environmental hazard.
Water	7732-18-5	Not Listed
2-propenamide	79-06-1	Listed. Environmental hazard.

INTERNATIONAL REGULATIONS

CHEMICAL WEAPONS CONVENTION (CWC):

This product does not contain any component(s) listed under the Chemical Weapons Convention Schedule of Chemicals.

DOMESTIC SUBSTANCE LIST (DSL) STATUS:

All components either exempt or listed on the DSL

SECTION 16 – OTHER INFORMATION

REASON FOR REVISION: Section(s) revised: 2,4,11,15 & NFPA/HMIS Rating

DISCLAIMER: The information contained herein is based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to such data or information. The user is responsible for determining whether the product is suitable for its intended conditions of use.



Univar USA Inc Material Safety Data Sheet

MSDS No:

Version No:

Order No:

Univar USA Inc., 17425 NE Union Hill Rd., Redmond WA 98052
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: CAUSTIC SODA 50%

SDS DATE: 04/08/2013
REPLACES: 09/21/2012

SAFETY DATA SHEET

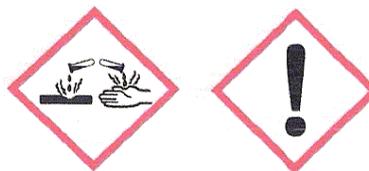
This Safety Data Sheet conforms to ANSI Z400.5, and to the format requirements and the International Chemical Safety Cards of the Global Harmonizing System.
THIS SDS COMPLIES WITH 29 CFR 1910.1200 (HAZARD COMMUNICATION STANDARD)
IMPORTANT: Read this SDS before handling & disposing of this product.
Pass this information on to employees, customers, & users of this product.

SECTION 1. IDENTIFICATION OF THE SUBSTANCE OR MIXTURE AND OF THE SUPPLIER

PRODUCT IDENTITY: CAUSTIC SODA 50%
SDS NUMBER: CDS1962
COMPANY IDENTITY: Univar
COMPANY ADDRESS: 17425 NE Union Hill Road
COMPANY CITY: Redmond, WA 98052
COMPANY PHONE: 1-425-889-3400
EMERGENCY PHONES: CHEMTREC: 1-800-424-9300 (USA)
CANUTEC: 1-613-996-6666 (CANADA)

SECTION 2. HAZARDS IDENTIFICATION

DANGER!!



EXPOSURE PREVENTION: AVOID ALL CONTACT!

HAZARD STATEMENTS:

H100s = General, H200s = Physical, H300s = Health, H400s = Environmental
H290 May be corrosive to metals.
H314 Causes severe skin burns and eye damage.

PRECAUTIONARY STATEMENTS:

P100s = General, P200s = Prevention, P300s = Response, P400s = Storage, P500s = Disposal
P262 Do not get in eyes, on skin, or on clothing.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P305+351+338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present & easy to do - Continue rinsing.
P309+311 If exposed or you feel unwell: Call a POISON CENTER or doctor/physician.
P405+102 Store locked up. Keep out of reach of children.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

MATERIAL	CAS#	EINECS#	WT %
Sodium Hydroxide	1310-73-2	215-185-5	48-52
Water	7732-18-5	231-791-2	48-52
Sodium Chloride	7647-14-5	-	0- 5

Trace components: Trace ingredients (if any) are present in < 1% concentration, (< 0.1% for potential carcinogens, reproductive toxins, respiratory tract mutagens, and sensitizers). None of the trace ingredients contribute significant additional hazards at the concentrations that may be present in this product. All pertinent hazard information has been provided in this document, per the requirements of the Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalents, and Canadian Hazardous Materials Identification System Standard (CPR 4).

SEE SECTIONS 8, 11 & 12 FOR TOXICOLOGICAL INFORMATION.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: CAUSTIC SODA 50%

SDS DATE: 04/08/2013
REPLACES: 09/21/2012

SECTION 4. FIRST AID MEASURES

EYE CONTACT:

If this product enters the eyes, open eyes while under gently running water. Use sufficient force to open eyelids. "Roll" eyes to expose more surface. Minimum flushing is for 15 minutes. Seek immediate medical attention.

SKIN CONTACT:

If the product contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove contaminated clothing, taking care not to contaminate eyes. If skin becomes irritated and irritation persists, medical attention may be necessary. Wash contaminated clothing before reuse, discard contaminated shoes.

INHALATION:

After high vapor exposure, remove to fresh air. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. Keep person warm and at rest. breathing is difficult, give oxygen. If breathing has stopped, trained personnel should immediately begin artificial respiration. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. If the heart has stopped, trained personnel should immediately begin cardiopulmonary resuscitation (CPR). Seek immediate medical attention. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

SWALLOWING:

If swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, give two glasses of water to drink. DO NOT INDUCE VOMITING. Never induce vomiting or give liquids to someone who is unconscious, having convulsions, or unable to swallow. Seek immediate medical attention.

NOTES TO PHYSICIAN:

There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Any material aspirated during vomiting may cause lung injury. Therefore, emesis should not be induced mechanically or pharmacologically. If it is considered necessary to evacuate the stomach contents, this should be done by means least likely to cause aspiration (such as: Gastric lavage after endotracheal intubation).

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take a copy of label and SDS to physician or health professional with victim.

SECTION 5. FIRE FIGHTING MEASURES

FIRE & EXPLOSION PREVENTIVE MEASURES

Isolate from extreme heat and open flame.

EXTINGUISHING MEDIA

In case of fire in surroundings, all extinguishing agents allowed.

SPECIAL FIRE FIGHTING PROCEDURES

Water spray may be ineffective on fire but can protect fire-fighters & cool closed containers. Use fog nozzles if water is used. Do not enter confined fire-space without full bunker gear. (Helmet with face shield, bunker coats, gloves & rubber boots). Use NIOSH approved positive-pressure self-contained breathing apparatus.

UNUSUAL EXPLOSION AND FIRE PROCEDURES

Noncombustible.

Isolate from acids.
Closed containers may explode if exposed to extreme heat.
Applying to hot surfaces requires special precautions.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: CAUSTIC SODA 50%

SDS DATE: 04/08/2013
REPLACES: 09/21/2012

SECTION 6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE AND ENVIRONMENTAL PRECAUTIONS:

Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area, protect people, and respond with trained personnel.

PERSONAL PROTECTIVE EQUIPMENT

The proper personal protective equipment for incidental releases (such as: 1 Liter of the product released in a well-ventilated area), use impermeable gloves (triple-gloves (rubber gloves and nitrile gloves, over latex gloves), goggles, face shield, and appropriate body protection. In the event of a large release, use impermeable gloves, specific for the material handled, chemically resistant suit and boots, and hard hat. Self-Contained Breathing Apparatus or respirator may be required where engineering controls are not adequate or conditions for potential exposure exist. When respirators are required, select NIOSH/MSHA approved based on actual or potential airborne concentrations in accordance with latest OSHA and/or ANSI recommendations.

ENVIRONMENTAL PRECAUTIONS:

Stop spill at source. Construct temporary dikes of dirt, sand, or any appropriate readily available material to prevent spreading of the material. Close or cap valves and/or block or plug hole in leaking container and transfer to another container. Keep from entering storm sewers and ditches which lead to waterways, and if necessary, call the local fire or police department for immediate emergency assistance.

CONTAINMENT AND CLEAN-UP MEASURES:

Absorb spilled liquid with polypads or other suitable absorbent materials. If necessary, neutralize using suitable buffering material, (acid with soda ash or base with phosphoric acid), and test area with litmus paper to confirm neutralization. Clean up with non-combustible absorbent (such as: sand, soil, and so on). Shovel up and place all spill residue in suitable containers. dispose of at an appropriate waste disposal facility according to current applicable laws and regulations and product characteristics at time of disposal (see Section 13 - Disposal Considerations).

SECTION 7. HANDLING AND STORAGE

HANDLING

Use only with adequate ventilation. Do not get in eyes, on skin or clothing. Wear OSHA Standard full face shield. Consult Safety Equipment Supplier. Wear goggles, face shield, gloves, apron & footwear impervious to material. Wash clothing before reuse. NEVER pour water into this substance. When dissolving or diluting, always add it slowly to the water.

STORAGE

Keep separated from strong oxidants, strong acids, metals, food & feedstuffs. Keep dry. Do not store above 49 C/120 F. Keep container tightly closed & upright when not in use to prevent leakage. Wear full face shield, gloves & full protective clothing when opening or handling. When empty, drain completely, replace bungs securely.

NONBULK: CONTAINERS:

Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers or in a diked area, as appropriate. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Empty containers should be handled with care. Never store food, feed, or drinking water in containers which held this product.

BULK CONTAINERS:

All tanks and pipelines which contain this material must be labeled. Perform routine maintenance on tanks or pipelines which contain this product. Report all leaks immediately to the proper personnel.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: CAUSTIC SODA 50%

SDS DATE: 04/08/2013
REPLACES: 09/21/2012

SECTION 7. HANDLING AND STORAGE (CONTINUED)

TANK CAR SHIPMENTS:

Tank cars carrying this product should be loaded and unloaded in strict accordance with tank-car manufacturer's recommendation and all established on-site safety procedures. Appropriate personal protective equipment must be used (see Section 8, Engineering Controls and Personal Protective Equipment.). All loading and unloading equipment must be inspected, prior to each use. Loading and unloading operations must be attended, at all times. Tank cars must be level, brakes must be set or wheels must be locked or blocked prior to loading or unloading. Tank car (for loading) or storage tanks (for unloading) must be verified to be correct for receiving this product and be properly prepared, prior to starting the transfer operations. Hoses must be verified to be in the correct positions, before starting transfer operations. A sample (if required) must be taken and verified (if required) prior to starting transfer operations. All lines must be blown-down and purged before disconnecting them from the tank car or vessel.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:

Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Collect all rinsates and dispose of according to applicable Federal, State, Provincial, or local procedures.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

MATERIAL	CAS#	EINECS#	TWA (OSHA)	TLV (ACGIH)
Sodium Hydroxide	1310-73-2	215-185-5	None Known	None Known
Water	7732-18-5	231-791-2	None Known	None Known
Sodium Chloride	7647-14-5	-	None Known	None Known

MATERIAL	CAS#	EINECS#	CEILING	STEL(OSHA/ACGIH)	HAP
Sodium Hydroxide	1310-73-2	215-185-5	2 ppm	None Known	No

This product contains no EPA Hazardous Air Pollutants (HAP) in amounts > 0.1%.

RESPIRATORY EXPOSURE CONTROLS

A respiratory protection program that meets OSHA 29 CFR 1910.134 and ANSI Z86.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

VENTILATION

LOCAL EXHAUST: Necessary MECHANICAL (GENERAL): Necessary
SPECIAL: None OTHER: None
Please refer to ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

PERSONAL PROTECTIONS:

Wear OSHA Standard full face shield. Consult Safety Equipment Supplier. Wear goggles, face shield, gloves, apron & footwear impervious to material. Wash clothing before reuse.

WORK & HYGIENIC PRACTICES:

Provide readily accessible eye wash stations & safety showers.
Wash at end of each workshift & before eating, smoking or using the toilet.
Promptly remove clothing that becomes contaminated. Destroy contaminated leather articles. Launder or discard contaminated clothing.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: CAUSTIC SODA 50%

SDS DATE: 04/08/2013
REPLACES: 09/21/2012

SECTION 9. PHYSICAL & CHEMICAL PROPERTIES

APPEARANCE:	Liquid, Water-White
ODOR:	None
ODOR THRESHOLD:	Not Available
pH (Neutrality):	14.0
MELTING POINT/FREEZING POINT:	Not Available
BOILING RANGE (IBP,50%,Dry Point):	Not Applicable
FLASH POINT (TEST METHOD):	Not Applicable
EVAPORATION RATE (n-BUTYL ACETATE=1):	Not Applicable
FLAMMABILITY CLASSIFICATION:	Non-Combustible
LOWER FLAMMABLE LIMIT IN AIR (% by vol):	Not Applicable
UPPER FLAMMABLE LIMIT IN AIR (% by vol):	Not Available
VAPOR PRESSURE (mm of Hg)@20 C	17.5
VAPOR DENSITY (air=1):	0.670
GRAVITY @ 68/68F / 20/20C:	
SPECIFIC GRAVITY (Water=1):	1.525
POUNDS/GALLON:	12.71
WATER SOLUBILITY:	Complete
PARTITION COEFFICIENT (n-Octane/Water):	Not Available
AUTO IGNITION TEMPERATURE:	Not Applicable
DECOMPOSITION TEMPERATURE:	Not Available

SECTION 10. STABILITY & REACTIVITY

STABILITY

Stable under normal conditions.

CONDITIONS TO AVOID

Isolate from extreme heat, and open flame..

MATERIALS TO AVOID

Reacts violently with fire extinguishers containing water.
The substance is a strong base, reacts violently with acids and is corrosive.
Reacts with water generating sufficient heat to ignite combustible materials.
Reacts violently with strong acids, causing fire & explosion hazard. Attacks many plastics, rubber, coatings, many metals, such as aluminum, zinc, tin, & lead, forming flammable/explosive gas (hydrogen).
Reacts with ammonium salts to produce ammonia & causing fire hazard.
Rapidly absorbs carbon dioxide & water from the air.
Contact with moisture will generate heat.

HAZARDOUS DECOMPOSITION PRODUCTS

Hydrogen Chloride, Phosgene, Sodium Oxide & Hydroxide from heating.

HAZARDOUS POLYMERIZATION

Will not occur.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: CAUSTIC SODA 50%

SDS DATE: 04/08/2013
REPLACES: 09/21/2012

SECTION 11. TOXICOLOGICAL INFORMATION

ACUTE HAZARDS

EYE & SKIN CONTACT:

Severe burns to skin, defatting, dermatitis.
Severe burns to eyes, redness, tearing, blurred vision.
Liquid can cause severe skin & eye burns. Wash thoroughly after handling.

INHALATION:

Severe respiratory tract irritation may occur. Vapor harmful.
The applicable occupational exposure limit value should not be exceeded during any part of the working exposure.

SWALLOWING:

Harmful or fatal if swallowed.

SUBCHRONIC HAZARDS/CONDITIONS AGGRAVATED

CONDITIONS AGGRAVATED:

None Known.

CHRONIC HAZARDS

CANCER, REPRODUCTIVE & OTHER CHRONIC HAZARDS:

This product has no carcinogens listed by IARC, NTP, NIOSH, OSHA or ACGIH, as of this date, greater or equal to 0.1%.

IRRITANCY OF PRODUCT: This product is irritating to contaminated tissue.

SENSITIZATION TO THE PRODUCT: No component of this product is known to be a sensitizer.

MUTAGENICITY: This product is not reported to produce mutagenic effects in humans.

EMBRYOTOXICITY: This product is not reported to produce embryotoxic effects in humans.

TERATOGENICITY: This product is not reported to produce teratogenic effects in humans.

REPRODUCTIVE TOXICITY: This product is not reported to cause reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (such as: within the eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MAMMALIAN TOXICITY INFORMATION

TOXICITY DATA: Toxicology information for components > 1% concentration is given below:

SODIUM HYDROXIDE:

Eye irritancy (monkey):	1%, 24 hours (severe)
Eye irritancy (rabbit):	500 ml, 24 hours (severe)
Eye irritancy (rabbit):	1% solution (severe)
Eye irritancy (rabbit):	1 mg, 24 hours (severe)
Cytogenic analysis system (grasshopper parenteral):	20 mg
LD50 (interperoneal, mouse):	40 mg/kg
LDLo (oral, rabbit):	500 mg/kg

LD50 - Dose that is lethal to 50% of a given species by a given route of exposure.

LC50 - Air concentration that is lethal to 50% of a given species in a given period of time.

LDL0 - Lowest lethal dose in a given species by a given route of exposure.

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: CAUSTIC SODA 50%

SDS DATE: 04/08/2013
REPLACES: 09/21/2012

SECTION 12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

EFFECT OF MATERIAL ON PLANTS AND ANIMALS:

This product may be harmful or fatal to plant and animal life if released into the environment. Refer to Section 11 (Toxicological Information) for further data on the effects of this product's components on test animals.

EFFECT OF MATERIAL ON AQUATIC LIFE:

SODIUM HYDROXIDE:

LC100 (Cyprinus carpio):	180 ppm/24 hours/25 C
TLm (mosquito fish):	125 ppm/96 hour (fresh water)
TLm (bluegill):	99 mg/L/48 hour (tap water)

MOBILITY IN SOIL

Mobility of this material has not been determined.

DEGRADABILITY

This product is completely biodegradable.

ACCUMULATION

Bioaccumulation of this product has not been determined.

SECTION 13. DISPOSAL CONSIDERATIONS

Processing, use or contamination may change the waste management options. Recycle / dispose of observing national, regional, state, provincial and local health, safety & pollution laws. If in doubt, contact appropriate agencies.

SECTION 14. TRANSPORT INFORMATION

IF > 1923 LB / 874 KG OF THIS PRODUCT IS IN 1 CONTAINER, IT EXCEEDS THE RQ OF SODIUM HYDROXIDE. "RQ" MUST BE PUT BEFORE THE DOT SHIPPING NAME.

DOT/TDG SHIP NAME: UN1824, Sodium hydroxide solution, 8, PG-II
DRUM LABEL: (CORROSIVE)
IATA / ICAO: UN1824, Sodium hydroxide solution, 8, PG-II
IMO / IMDG: UN1824, Sodium hydroxide solution, 8, PG-II
EMERGENCY RESPONSE GUIDEBOOK NUMBER: 154

SECTION 15. REGULATORY INFORMATION



EPA REGULATION:

SARA SECTION 311/312 HAZARDS: Acute Health

All components of this product are on the TSCA list.

SARA Title III Section 313 Supplier Notification

This product contains the indicated <*> toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning & Community Right-To-Know Act of 1986 & of 40 CFR 372. This information must be included in all MSDSs that are copied and distributed for this material.

SARA TITLE III INGREDIENTS	CAS#	EINECS#	WT%	(REG.SECTION)	RQ(LBS)
Sodium Hydroxide	1310-73-2	215-185-5	48-52	(311,312)	1000

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: CAUSTIC SODA 50%

SDS DATE: 04/08/2013
REPLACES: 09/21/2012

SECTION 15. REGULATORY INFORMATION (CONTINUED)

Any release equal to or exceeding the RQ must be reported to the National Response Center (800-424-8802) and appropriate state and local regulatory agencies as described in 40 CFR 302.6 and 40 CFR 355.40 respectively. Failure to report may result in substantial civil and criminal penalties. State & local regulations may be more restrictive than federal regulations.

STATE REGULATIONS:

CALIFORNIA SAFE DRINKING WATER & TOXIC ENFORCEMENT ACT (PROPOSITION 65):
This product contains no chemicals known to the State of California to cause cancer or reproductive toxicity.

INTERNATIONAL REGULATIONS

The components of this product are listed on the chemical inventories of the following countries:
Australia (AICS), Canada (DSL, NDSL), China (IECSC), Europe (EINECS, ELINCS), Japan (METI/CSCL, MHLW/ISHL), South Korea (KECI), New Zealand (NZIoC), Philippines (PICCS), Switzerland (SWISS), Taiwan (NECSI), USA (TSCA).

CANADA: WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)

D2B: Irritating to skin / eyes.
E: Corrosive Material.

SECTION 16. OTHER INFORMATION

HAZARD RATINGS:

HEALTH (NFPA): 3, HEALTH (HMIS): 3, FLAMMABILITY: 0, PHYSICAL HAZARD: 1
(Personal Protection Rating to be supplied by user based on use conditions.)
This information is intended solely for the use of individuals trained in the NFPA & HMIS hazard rating systems.

EMPLOYEE TRAINING

See Section 2 for Risk & Safety Statements. Employees should be made aware of all hazards of this material (as stated in this SDS) before handling it.

Univar USA Inc Material Safety Data Sheet

For Additional Information contact MSDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process



Univar USA Inc Safety Data Sheet

SDS No:

Version No:

Order No:

3075 Highland Pkwy, Ste 200, Downers Grove, IL 60515
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300



Univar
3075 Highland Pkwy STE 200
Downers Grove, IL 60515
425-889-3400

SAFETY DATA SHEET

1. Identification

Product identifier: BLEND LOW FREEZE CAUSTIC

Other means of identification

SDS number: 000100000089

Recommended use and restriction on use

Recommended use: Not available.

Restrictions on use: Not known.

Emergency telephone number:For emergency assistance Involving chemicals

call CHEMTREC day or night at: 1-800-424-9300. CHEMTREC INTERNATIONAL Tel# 703-527-3887

2. Hazard(s) identification

Hazard classification

Health hazards

Acute toxicity (Oral) Category 4

Skin corrosion/irritation Category 1A

Serious eye damage/eye irritation Category 1

Environmental hazardsAcute hazards to the aquatic environment Category 3

Label elements

Hazard symbol



Version: 1.0
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Signal word	Danger
Hazard statement	Corrosive. Harmful if swallowed. Causes severe skin burns and eye damage. Harmful to aquatic life.
Precautionary statement	
Prevention	Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Do not breathe dust or mists. Wear protective gloves/protective clothing/eye protection/face protection. Do not get in eyes, on skin, or on clothing.
Response	IF INHALED: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. IF SWALLOWED: Call a POISON CENTER/doctor/ if you feel unwell. Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CENTER/doctor. Specific treatment (see this label). Wash contaminated clothing before reuse.
Storage	Keep container tightly closed. Store in a well-ventilated place. Store in a dry place. Store locked up.
Disposal	Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.
Other hazards which do not result in GHS classification	None.

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3. Composition/information on ingredients

Mixtures

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
Sodium hydroxide		1310-73-2	>=45 - <=55%
Potassium hydroxide		1310-58-3	>=0 - <=5%
Water		7732-18-5	>=45 - <=55%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information:	CAUTION! First aid personnel must be aware of own risk during rescue!
Ingestion:	Do NOT induce vomiting. Never give liquid to an unconscious person. Get medical attention immediately.
Inhalation:	Move to fresh air. If breathing is difficult, give oxygen. Perform artificial respiration if breathing has stopped.
Skin contact:	Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Eye contact:	If in eyes, hold eyes open, flood with water for at least 15 minutes and see a doctor.
Most important symptoms/effects, acute and delayed	
Symptoms:	No data available.

Indication of immediate medical attention and special treatment needed

Treatment: No data available.

5. Fire-fighting measures

General fire hazards: No data available.
Suitable (and unsuitable) extinguishing media

Suitable extinguishing media: In case of fire in the surroundings: all extinguishing agents allowed.

Unsuitable extinguishing media: No data available.

Specific hazards arising from the chemical: No data available.

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Special protective equipment and precautions for firefighters

Special fire fighting procedures: No data available.

Special protective equipment for fire-fighters: No data available.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures: Use personal protective equipment. Keep unauthorized personnel away.

Methods and material for containment and cleaning up: Absorb spillage with non-combustible, absorbent material. Dike for later disposal.

7. Handling and storage

Precautions for safe handling: Use personal protective equipment as required. All handling to take place in well-ventilated area. Container must be kept tightly closed.

Conditions for safe storage, including any incompatibilities: No data available.

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8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values	Source
Sodium hydroxide	Ceiling	2 mg/m3	US. ACGIH Threshold Limit Values (03 2013)
	Ceil_Tim e	2 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	2 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	Ceiling	2 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	Ceiling	2 mg/m3	US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A (06 2008)
Sodium hydroxide - Particulate.	ST ESL	20 µg/m3	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (02 2013)
	AN ESL	2 µg/m3	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (02 2013)
Sodium hydroxide	Ceiling	2 mg/m3	US. California Code of Regulations, Title 8, Section 5155. Airborne Contaminants (02 2012)
Potassium hydroxide	Ceiling	2 mg/m3	US. ACGIH Threshold Limit Values (03 2013)
	REL	2 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	Ceiling	2 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	Ceiling	2 mg/m3	US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A (06 2008)
Potassium hydroxide - Particulate.	AN ESL	2 µg/m3	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (02 2013)
	ST ESL	20 µg/m3	US. Texas. Effects Screening Levels (Texas Commission on Environmental

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			Quality) (02 2013)
Potassium hydroxide	Ceiling	2 mg/m3	US. California Code of Regulations, Title 8, Section 5155. Airborne Contaminants (02 2012)

Appropriate engineering controls No data available.

Individual protection measures, such as personal protective equipment

General information: Use personal protective equipment as required. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Practice good housekeeping.

Eye/face protection: Wear a face shield when working with molten material.

Skin protection

Hand protection: No data available.

Other: No data available.

Respiratory protection: No data available.

Hygiene measures: No data available.

9. Physical and chemical properties

Physical state: Liquid

Form: No data available.

Color: No data available.

Odor: No data available.

Odor threshold: No data available.

pH: 14

Melting point/freezing point: No data available.

Initial boiling point and boiling range: No data available.

Flash Point: No data available.

Evaporation rate: No data available.

Flammability (solid, gas): No data available.

Upper/lower limit on flammability or explosive limits

Flammability limit - upper (%): No data available.

Flammability limit - lower (%): No data available.

Explosive limit - upper (%): No data available.

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Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Relative density:	No data available.
Solubility(ies)	
Solubility in water:	No data available.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	No data available.
Chemical stability:	No data available.
Possibility of hazardous reactions:	No data available.
Conditions to avoid:	No data available.
Incompatible materials:	No data available.
Hazardous decomposition products:	No data available.

11. Toxicological information

Symptoms related to the physical, chemical and toxicological characteristics

Ingestion:	No data available.
Inhalation:	No data available.
Skin contact:	No data available.
Eye contact:	No data available.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral	
Product:	ATEmix (): 319.921875 mg/kg
Dermal	
Product:	No data available.
Inhalation	
Product:	No data available.

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Repeated dose toxicity
Product: No data available.

Skin corrosion/irritation
Product: No data available.

Serious eye damage/eye irritation
Product: No data available.

Respiratory or skin sensitization
Product: No data available.

Carcinogenicity
Product: No data available.
IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity
In vitro
Product: No data available.
In vivo
Product: No data available.

Reproductive toxicity
Product: No data available.

Specific target organ toxicity - single exposure
Product: No data available.

Specific target organ toxicity - repeated exposure
Product: No data available.

Aspiration hazard
Product: No data available.
Other effects: No data available.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product: No data available.

Specified substance(s):

Sodium hydroxide LC 50 (Western mosquitofish (*Gambusia affinis*), 24 h): 125 mg/l Mortality

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LC 50 (Guppy (Poecilia reticulata), 24 h): 145 mg/l Mortality LC 50 (Goldfish (Carassius auratus), 24 h): 160 mg/l Mortality LC 50 (Bony fish superclass (Osteichthyes), 48 h): 33 - 100 mg/l Mortality LC 50 (Western mosquitofish (Gambusia affinis), 48 h): 125 mg/l Mortality

Potassium hydroxide

LC 50 (Guppy (Poecilia reticulata), 24 h): 165 mg/l Mortality LC 50 (Western mosquitofish (Gambusia affinis), 24 h): 85 mg/l Mortality LC 50 (Western mosquitofish (Gambusia affinis), 48 h): 80 mg/l Mortality LC 50 (Western mosquitofish (Gambusia affinis), 96 h): 80 mg/l Mortality

Aquatic invertebrates

Product: No data available.

Specified substance(s):

Sodium hydroxide

EC 50 (Water flea (Ceriodaphnia dubia), 48 h): 34.59 - 47.13 mg/l Intoxication LC 50 (Common shrimp, sand shrimp (Crangon crangon), 48 h): 33 - 100 mg/l Mortality LC 50 (Cockle (Cerastoderma edule), 48 h): 330 - 1,000 mg/l Mortality

Chronic hazards to the aquatic environment:

Fish

Product: No data available.

Aquatic invertebrates

Product: No data available.

Toxicity to Aquatic Plants

Product: No data available.

Persistence and degradability

Biodegradation

Product: No data available.

BOD/COD ratio

Product: No data available.

Bioaccumulative potential

Bioconcentration factor (BCF)

Product: No data available.

Partition coefficient n-octanol / water (log Kow)

Product: No data available.

Mobility in soil:

No data available.

Known or predicted distribution to environmental compartments

Sodium hydroxide No data available.

Potassium hydroxide No data available.

Water No data available.

Known or predicted distribution to environmental compartments

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Water No data available.

13. Disposal considerations

Disposal instructions: No data available.
Contaminated packaging: No data available.

14. Transport information

DOT

UN number: UN 3266
UN proper shipping name: Corrosive liquid, basic, inorganic, n.o.s.(Sodium hydroxide, Potassium hydroxide)
Transport hazard class(es)
Class: 8
Label(s): 8
Packing group: II
Marine Pollutant: Not regulated.
Special precautions for user: -

IMDG

UN number: UN 3266
UN proper shipping name: CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.
Transport hazard class(es)
Class: 8
Label(s): 8
EmS No.: F-A, S-B
Packing group: II
Marine Pollutant: Not regulated.
Special precautions for user: -

IATA

UN number: UN 3266
Proper Shipping Name: Corrosive liquid, basic, inorganic, n.o.s.
Transport hazard class(es):
Class: 8
Label(s): 8
Packing group: II
Environmental hazards: Not regulated.
Special precautions for user: -
Other information

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Passenger and cargo aircraft: Allowed.
Cargo aircraft only: Allowed.

15. Regulatory information

US federal regulations US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

Sodium hydroxide Reportable quantity: 1000 lbs.

Potassium hydroxide Reportable quantity: 1000 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

Not listed.

SARA 302 Extremely hazardous substance

None present or none present in regulated quantities.

SARA 304 Emergency release notification

Chemical identity	RQ
Sodium hydroxide	1000 lbs.
Potassium hydroxide	1000 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
Sodium hydroxide	500 lbs
Potassium hydroxide	500 lbs

SARA 313 (TRI reporting)

None present or none present in regulated quantities.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

Sodium hydroxide Reportable quantity: 1000 lbs.

Potassium hydroxide Reportable quantity: 1000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

None present or none present in regulated quantities.

US state regulations

US. California Proposition 65

No ingredient regulated by CA Prop 65 present.

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US. New Jersey Worker and Community Right-to-Know Act

Sodium hydroxide Listed

Potassium hydroxide Listed

US. Massachusetts RTK - Substance List

Sodium hydroxide Listed

Potassium hydroxide Listed

US. Pennsylvania RTK - Hazardous Substances

Sodium hydroxide Listed

Potassium hydroxide Listed

US. Rhode Island RTK

Sodium hydroxide Listed

Potassium hydroxide Listed

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Inventory Status: Australia AICS:	Not in compliance with the inventory.
Canada DSL Inventory List:	Not in compliance with the inventory.
EU EINECS List:	On or in compliance with the inventory
EU ELINCS List:	Not in compliance with the inventory.
Japan (ENCS) List:	Not in compliance with the inventory.
EU No Longer Polymers List:	Not in compliance with the inventory.
China Inv. Existing Chemical Substances:	Not in compliance with the inventory.
Korea Existing Chemicals Inv. (KECI):	Not in compliance with the inventory.
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	Not in compliance with the inventory.
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	Not in compliance with the inventory.
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16. Other information, including date of preparation or last revision

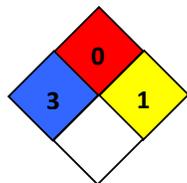
HMIS Hazard ID

Health	*	3
Flammability	0	
Physical hazards	2	
PERSONAL PROTECTION		B

B - Safety Glasses & Gloves

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe; *Chronic health effect

NFPA Hazard ID



	Flammability
	Health
	Reactivity
	Special hazard.

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue date: 05/19/2015
Revision date: No data available.
Version #: 1.0
Further information: No data available.

Version: 1.0
Revision date: 05/19/2015



Univar USA Inc Safety Data Sheet

For Additional Information contact SDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this SDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process



Univar USA Inc Material Safety Data Sheet

MSDS No:

Version No:

Order No:

Univar USA Inc., 17425 NE Union Hill Rd., Redmond WA 98052
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

aCOMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: CAUSTIC POTASH 45% - UNIVAR DIST

DATE: 03/05/11
PAGE: 1 OF 8

SAFETY DATA SHEET

This Safety Data Sheet conforms to ANSI Z400.5, and to the format requirements and the International Chemical Safety Cards of the Global Harmonizing System. THIS SDS COMPLIES WITH 29 CFR 1910.1200 (HAZARD COMMUNICATION STANDARD)
IMPORTANT: Read this SDS before handling & disposing of this product.
Pass this information on to employees, customers, & users of this product.

SECTION 1. IDENTIFICATION OF THE SUBSTANCE OR MIXTURE AND OF THE SUPPLIER

PRODUCT IDENTITY: CAUSTIC POTASH 45% - UNIVAR DIST
SDS NUMBER: CDS1780
NEW MSDS DATE: 03/05/2011
COMPANY IDENTITY: Univar USA Inc.
COMPANY ADDRESS: 17425 NE Union Hill Road
COMPANY CITY: Redmond, WA 98052
COMPANY PHONE: 1-425-889-3400
EMERGENCY PHONES: CHEMTREC: 1-800-424-9300 (USA)
CANUTEC: 1-613-996-6666 (CANADA)

SECTION 2. HAZARDS IDENTIFICATION

DANGER!!

EXPOSURE PREVENTION: AVOID ALL CONTACT!

RISK STATEMENTS:

R35 Causes severe burns.

SAFETY STATEMENTS:

S1/2 Keep locked up and out of the reach of children.
S24/25 Avoid contact with skin and eyes.
S36/37/39 Wear suitable protective clothing, gloves, and eye/face protection.
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S45 In case of accident, or if you feel unwell, seek medical advice immediately. (Show the label where possible).

SEE SECTIONS 8, 11 & 12 FOR TOXICOLOGICAL INFORMATION.



COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: CAUSTIC POTASH 45% - UNIVAR DIST

DATE: 03/05/11
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SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

MATERIAL	CAS#	EINECS#	WT %
Water	7732-18-5	231-791-2	55%
Potassium Hydroxide*	1310-58-3	215-181-3	45%

SECTION 4. FIRST AID MEASURES

EYE CONTACT:

For eyes, flush with plenty of water for 15 minutes & get medical attention.

SKIN CONTACT:

In case of contact with skin immediately remove contaminated clothing.
Wash thoroughly with soap & water. Wash contaminated clothing before reuse.

INHALATION:

After high vapor exposure, remove to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, trained personnel should immediately begin artificial respiration. If the heart has stopped, trained personnel should immediately begin cardiopulmonary resuscitation (CPR).

SWALLOWING:

Rinse mouth. Give plenty of water to drink. Do NOT induce vomiting.
GET MEDICAL ATTENTION IMMEDIATELY. Do NOT give liquids to an unconscious or convulsing person.

SECTION 5. FIRE FIGHTING MEASURES

FIRE & EXPLOSION PREVENTIVE MEASURES

Reacts with some metals, such as aluminum, zinc, tin, & lead.
forming flammable/explosive gas (hydrogen).

EXTINGUISHING MEDIA

Use dry powder, In case of fire in surroundings,
all extinguishing agents allowed.

SPECIAL FIRE FIGHTING PROCEDURES

Water spray may be ineffective on fire but can protect fire-fighters & cool closed containers. Use fog nozzles if water is used.
Do not enter confined fire-space without full bunker gear.
(Helmet with face shield, bunker coats, gloves & rubber boots).
Use NIOSH approved positive-pressure self-contained breathing apparatus.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: CAUSTIC POTASH 45% - UNIVAR DIST

DATE: 03/05/11
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SECTION 5. FIRE FIGHTING MEASURES (CONTINUED)

UNUSUAL EXPLOSION AND FIRE PROCEDURES

Noncombustible.

Isolate from acids.

Closed containers may explode if exposed to extreme heat.

Applying to hot surfaces requires special precautions.

SECTION 6. ACCIDENTAL RELEASE MEASURES

PERSONAL PROTECTIVE MEASURES:

Keep unprotected personnel away.

Use complete chemical protective suit with self-contained breathing apparatus.

ENVIRONMENTAL PRECAUTIONS:

Keep from entering storm sewers and ditches which lead to waterways.

CONTAINMENT AND CLEAN-UP MEASURES:

Stop spill at source. Dike and contain.

Sweep spilled material into dry, sealable containers.

Wash away remainder with plenty of water.

SECTION 7. HANDLING AND STORAGE

HANDLING

Use only with adequate ventilation. Do not get in eyes, on skin or clothing.

Wear OSHA Standard full face shield. Consult Safety Equipment Supplier. Wear gloves, apron & footwear impervious to this material. Wash clothing before reuse.

NEVER pour water into this substance. When dissolving or diluting, always add it slowly to the water.

To minimize static discharge when transferring, ensure electrical continuity by bonding and grounding all equipment. Use an inlet line diameter of at

least 3.5 inches (8.9 centimeters) with a maximum flow rate of 1 meter/second.

STORAGE

Keep separated from strong oxidants, strong acids, metals, food & feedstuffs.

Keep dry. Do not store above 49 C/120 F.

Keep container tightly closed & upright when not in use to prevent leakage.

Wear full face shield, gloves & full protective clothing when opening or handling.

When empty, drain completely, replace bungs securely.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: CAUSTIC POTASH 45% - UNIVAR DIST

DATE: 03/05/11
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SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

MATERIAL	CAS#	EINECS#	TWA (OSHA)	TLV (ACGIH)
Potassium Hydroxide*	1310-58-3	215-181-3	None Known	None Known
Water	7732-18-5	231-791-2	None Known	None Known

MATERIAL	CAS#	EINECS#	CEILING	STEL(OSHA/ACGIH)	HAP
Potassium Hydroxide*	1310-58-3	215-181-3	2 ppm	None Known	No

This product contains no EPA Hazardous Air Pollutants (HAP) in amounts > 0.1%.

RESPIRATORY EXPOSURE CONTROLS

A respiratory protection program that meets OSHA 29 CFR 1910.134 and ANSI Z86.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

VENTILATION

LOCAL EXHAUST: Necessary MECHANICAL (GENERAL): Necessary
SPECIAL: None OTHER: None
Please refer to ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

PERSONAL PROTECTIONS:

Wear OSHA Standard full face shield. Consult Safety Equipment Supplier. Wear gloves, apron & footwear impervious to this material. Wash clothing before reuse.

WORK & HYGIENIC PRACTICES:

Provide readily accessible eye wash stations & safety showers.
Wash at end of each workshift & before eating, smoking or using the toilet.
Promptly remove clothing that becomes contaminated. Destroy contaminated leather articles. Launder or discard contaminated clothing.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: CAUSTIC POTASH 45% - UNIVAR DIST

DATE: 03/05/11
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SECTION 9. PHYSICAL & CHEMICAL PROPERTIES

APPEARANCE:	Liquid, Water-White
ODOR:	None
ODOR THRESHOLD:	Not Available
pH (Neutrality):	14.0
MELTING POINT/FREEZING POINT:	-20 F
BOILING RANGE (IBP,50%,Dry Point):	Not Applicable
FLASH POINT (TEST METHOD):	Not Applicable
EVAPORATION RATE (n-BUTYL ACETATE=1):	Not Applicable
FLAMMABILITY CLASSIFICATION:	Non-Combustible
LOWER FLAMMABLE LIMIT IN AIR (% by vol):	Not Applicable
UPPER FLAMMABLE LIMIT IN AIR (% by vol):	Not Available
VAPOR PRESSURE (mm of Hg)@20 C	17.5
VAPOR DENSITY (air=1):	0.670
GRAVITY @ 68/68F / 20/20C:	
SPECIFIC GRAVITY (Water=1):	1.450
POUNDS/GALLON:	12.079
WATER SOLUBILITY:	Complete
PARTITION COEFFICIENT (n-Octane/Water):	Not Available
AUTO IGNITION TEMPERATURE:	Not Applicable
DECOMPOSITION TEMPERATURE:	Not Available
REFRACTIVE INDEX:	1.333
VOC'S (>0.44 Lbs/Sq In) :	0.0 Vol% /0.0 g/L / 0.000 Lbs/Gal
TOTAL VOC'S (TVOC)*:	0.0 Vol% /0.0 g/L / 0.000 Lbs/Gal
NONEXEMPT VOC'S (CVOC)*:	0.0 Vol% /0.0 g/L / 0.000 Lbs/Gal
HAZARDOUS AIR POLLUTANTS (HAPS):	0.0 Wt% /0.0 g/L / 0.000 Lbs/Gal
NONEXEMPT VOC PARTIAL PRESSURE (mm of Hg @ 20 C)	0.0

* Using California South Coast Air Quality Management District (SCAQMD) Rule 443.1.

SECTION 10. STABILITY & REACTIVITY

STABILITY

Stable under normal conditions.

CONDITIONS TO AVOID

Isolate from acids.

MATERIALS TO AVOID

Reacts violently with fire extinguishers containing water.
The substance is a strong base, reacts violently with acids and is corrosive.
Reacts with water generating sufficient heat to ignite combustible materials.
Reacts violently with strong acids, causing fire & explosion hazard. Attacks many plastics, rubber, coatings, many metals, such as aluminum, zinc, tin, & lead. forming flammable/explosive gas (hydrogen).
Reacts with ammonium salts to produce ammonia & causing fire hazard.
Rapidly absorbs carbon dioxide & water from the air.
Contact with moisture will generate heat.

HAZARDOUS DECOMPOSITION PRODUCTS

Potassium Oxide & Hydroxide from heating.

HAZARDOUS POLYMERIZATION

Will not occur.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: CAUSTIC POTASH 45% - UNIVAR DIST

DATE: 03/05/11
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SECTION 11. TOXICOLOGICAL INFORMATION

ACUTE HAZARDS

EYE & SKIN CONTACT:

Severe burns to skin, defatting, dermatitis.
Severe burns to eyes, redness, tearing, blurred vision.
Liquid can cause severe skin & eye burns. Wash thoroughly after handling.

INHALATION:

Severe respiratory tract irritation may occur. Vapor harmful.
The applicable occupational exposure limit value should not be exceeded during any part of the working exposure.

SWALLOWING:

Harmful or fatal if swallowed.

SUBCHRONIC HAZARDS/CONDITIONS AGGRAVATED

CONDITIONS AGGRAVATED:

None Known.

CHRONIC HAZARDS

CANCER, REPRODUCTIVE & OTHER CHRONIC HAZARDS:

This product has no carcinogens listed by IARC, NTP, NIOSH, OSHA or ACGIH, as of this date, greater or equal to 0.1%.

MAMMALIAN TOXICITY INFORMATION

No mammalian information is available on this product.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: CAUSTIC POTASH 45% - UNIVAR DIST

DATE: 03/05/11
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SECTION 12. ECOLOGICAL INFORMATION

AQUATIC ANIMAL INFORMATION:

No aquatic environmental information is available on this product.
The substance may be hazardous in the environment.
Special attention should be given to water organisms.

MOBILITY IN SOIL

Mobility of this material has not been determined.

DEGRADABILITY

This product is completely biodegradable.

ACCUMULATION

This product does not bioaccumulate.

SECTION 13. DISPOSAL CONSIDERATIONS

Processing, use or contamination may change the waste management options.
Recycle / dispose of observing national, regional, state, provincial and local
health, safety & pollution laws. If in doubt, contact appropriate agencies.

SECTION 14. TRANSPORT INFORMATION

DOT SHIPPING NAME: UN1814, Potassium Hydroxide solution, 8, PG-II
DRUM LABEL: (CORROSIVE)
IATA / ICAO: UN1814, Potassium Hydroxide solution, 8, PG-II
IMO / IMDG: UN1814, Potassium Hydroxide solution, 8, PG-II
EMERGENCY RESPONSE GUIDEBOOK NUMBER: 154



> 1770 LB / 804 KG OF THIS PRODUCT IN 1 CONTAINER EXCEEDS THE "RQ" OF POTASSIUM HYDROXIDE.

SECTION 15. REGULATORY INFORMATION

EPA REGULATION:

SARA SECTION 311/312 HAZARDS: Acute Health

All components of this product are on the TSCA list.
This material contains no known products restricted under SARA Title III,
Section 313 in amounts greater or equal to 1%.

SARA TITLE III INGREDIENTS	CAS#	EINECS#	WT%	(REG.SECTION)	RQ(LBS)
Potassium Hydroxide*	1310-58-3	215-181-3	50-60	(311,312)	1000

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: CAUSTIC POTASH 45% - UNIVAR DIST

DATE: 03/05/11
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SECTION 15. REGULATORY INFORMATION (CONTINUED)

> 1770 LB / 804 KG OF THIS PRODUCT IN 1 CONTAINER EXCEEDS THE "RQ" OF POTASSIUM HYDROXIDE.
Any release equal to or exceeding the RQ must be reported to the National Response Center (800-424-8802) and appropriate state and local regulatory agencies as described in 40 CFR 302.6 and 40 CFR 355.40 respectively.
Failure to report may result in substantial civil and criminal penalties.
State & local regulations may be more restrictive than federal regulations.

STATE REGULATIONS:

CALIFORNIA PROPOSITION 65: This product contains no chemicals known to the State of California to cause cancer & reproductive toxicity.

INTERNATIONAL REGULATIONS

The components of this product are listed on the chemical inventories of the following countries:

Australia (AICS), Canada (DSL, NDSL), China (IECSC), Europe (EINECS, ELINCS), Japan (METI/CSCL, MHLW/ISHL), South Korea (KECI), New Zealand (NZIoC), Philippines (PICCS), Switzerland (SWISS), Taiwan (NECSI), USA (TSCA).

CANADA: WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)

D2B: Irritating to skin / eyes.

E: Corrosive Material.

SECTION 16. OTHER INFORMATION

HAZARD RATINGS:

HEALTH (NFPA): 3, HEALTH (HMIS): 3, FLAMMABILITY: 0, REACTIVITY: 2
(Personal Protection Rating to be supplied by user based on use conditions.)
This information is intended solely for the use of individuals trained in the NFPA & HMIS hazard rating systems.

EMPLOYEE TRAINING

See Section 2 for Risk & Safety Statements. Employees should be made aware of all hazards of this material (as stated in this SDS) before handling it.

Univar USA Inc Material Safety Data Sheet

For Additional Information contact MSDS Coordinator during business hours, Pacific time: (425) 889-3400

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This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process



Univar USA Inc Material Safety Data Sheet

MSDS No:

Version No:

Order No:

Univar USA Inc., 17425 NE Union Hill Rd., Redmond WA 98052
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

The Version Date and Number for this MSDS is : 09/24/2009 - #009

PRODUCT NAME: HYDROCHLORIC ACID (HCl) (ALL GRADES)
MSDS NUMBER: OZ34514
DATE ISSUED: 07/30/2008
SUPERSEDES: 01/26/2006
ISSUED BY: 008730

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Distributed by:
Univar USA Inc.
17425 NE Union Hill Road
Redmond, WA 98052
425-889-3400

Trade Name: HYDROCHLORIC ACID (HCl) (ALL GRADES)

Synonyms:
Muriatic Acid
HCl Solution
Aqueous hydrogen chloride

Product Use: Process chemical, Metal cleaning, Water purification, Petroleum Industry

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

Color: Colorless
Physical State: Liquid
Appearance: Clear
Odor: Irritating, Pungent, Sharp
Signal Word: Danger

MAJOR HEALTH HAZARDS: CAUSES BURNS TO THE RESPIRATORY TRACT, SKIN AND EYES.
CAUSES PERMANENT EYE DAMAGE. DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING.

PHYSICAL HAZARDS: May spatter or generate heat when mixed with water. Contact

Annotation:

with metals may evolve flammable hydrogen gas.

PRECAUTIONARY STATEMENTS: Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Wash thoroughly after handling. Use only with adequate ventilation.

2. HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS:

Inhalation: May cause irritation (possibly severe), chemical burns, and pulmonary edema.

Skin contact: May cause irritation (possibly severe) and chemical burns.

Eye contact: May cause irritation (possibly severe), chemical burns, eye damage, and blindness. Ingestion: Not a likely route of exposure.

Target Organs Affected: Respiratory System, Skin, Eye

Chronic Effects: Repeated or prolonged exposure to dilute solutions may result in dermatitis. Discoloration of the teeth may occur as a result of long term exposure.

Interaction with Other Chemicals Which Enhance Toxicity: None known

Medical Conditions Aggravated by Exposure: None known

See Section 11: TOXICOLOGICAL INFORMATION

3. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Component	Concentration (by weight %)	CAS - No.
Water	63 91	7732-18-5
Hydrogen chloride	9 - 36	7647-01-0

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. If respiration or pulse has stopped, have a trained person administer basic life support (Cardio-Pulmonary Resuscitation and/or Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

SKIN CONTACT: Immediately flush contaminated areas with water. Remove contaminated clothing, jewelry, and shoes immediately. Wash contaminated areas with soap and water. Thoroughly clean and dry contaminated clothing and shoes before reuse. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT: Immediately flush eyes with a directed stream of water for at

Annotation:

least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION: Not a likely route of exposure.

5. FIRE-FIGHTING MEASURES

Fire Hazard: Negligible fire hazard.

Extinguishing Media: Use media appropriate for surrounding fire

Fire Fighting: Keep unnecessary people away, isolate hazard area and deny entry. Wear NIOSH approved positive-pressure self-contained breathing apparatus operated in pressure demand mode. Move container from fire area if it can be done without risk. Cool non-leaking containers with water. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.

Sensitivity to Mechanical Impact: Not sensitive.

Sensitivity to Static Discharge: Not sensitive.

Flash point: Not flammable

Hazardous Combustion Products: Hydrogen chloride, Chlorine, Hydrogen gas

6. ACCIDENTAL RELEASE MEASURES

Occupational Release:

Remove sources of ignition. Wear appropriate personal protective equipment recommended in Section 8 of the MSDS. Stop leak if possible without personal risk. Consider evacuation of personnel located downwind if material is leaking. Shut off ventilation system if needed. Completely contain spilled material with dikes, sandbags, etc. Neutralize with soda ash or dilute caustic soda. Collect with appropriate absorbent and place into suitable container. Liquid material may be removed with a properly rated vacuum truck. Keep out of water supplies and sewers. This material is acidic and may lower the pH of the surface waters with low buffering capacity. Releases should be reported, if required, to appropriate agencies.

7. HANDLING AND STORAGE

Storage Conditions: Store and handle in accordance with all current regulations and standards. Store in rubber-lined steel, acid-resistant plastic or glass containers. Keep container tightly closed. Store in a cool, dry area. Store in a well-ventilated area. Keep away from heat, sparks and open flames. Keep separated from incompatible substances. Do not store in aluminum container or use aluminum fittings or transfer lines. Protect from physical damage. Dike and vent storage tanks.

Handling Procedures: Avoid breathing vapor or mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. When mixing, slowly add to water to minimize heat generation and spattering.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

OSHA Regulatory Exposure limit(s):

Hazardous Component	CAS-No.	OSHA Final PEL		OSHA Final PEL
		TWA	STEL	Ceiling
Hydrogen chloride	7647-01-0			5 ppm 7 mg/m3

Non-Regulatory Exposure Limit(s):

The Non-Regulatory OSHA limits shown in the table are the Vacated 1989 PEL's (vacated by 58 FR 35338, June 30, 1993).

Hazardous Component	CAS-No.	ACGIH	ACGIH	ACGIH	OSHA	OSHA	OSHA Ceiling
		TWA	STEL	Ceiling	TWA	STEL	(Vacated)
Hydrogen chloride	7647-01-0			2 ppm			5 ppm 7 mg/m3

ENGINEERING CONTROLS: Use closed systems when possible. Provide local exhaust ventilation where vapor or mist may be generated. Ensure compliance with applicable exposure limits.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection: Wear chemical safety goggles with a faceshield to protect against eye and skin contact when appropriate. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin and Body Protection: Wear chemical resistant clothing and rubber boots when potential for contact with the material exists. Always place pants legs over boots.

Hand Protection: Wear appropriate chemical resistant gloves

Protective Material Types: Nitrile, Neoprene, Butyl rubber, Polyvinyl chloride (PVC), Responder, Trelchem, Tychem

Hazardous Component	Immediately Dangerous to Life/ Health (IDLH)
Hydrogen chloride	50 ppm IDLH

Respiratory Protection: A NIOSH approved full-face respirator equipped with acid gas cartridges (appropriate for hydrogen chloride) may be permissible under certain circumstances where airborne concentrations of hydrogen chloride are expected to exceed exposure limits, or when symptoms have been observed that are indicative of overexposure. When the level may be above the

Annotation:

IDLH, use an SCBA or pressure-demand supplied air with an auxiliary self-contained escape pack. Pressure-demand SCBA (self-contained breathing apparatus) must be used when there is a potential for uncontrolled release or unknown concentrations. A respiratory protection program that meets 29 CFR 1910.134 must be followed whenever workplace conditions warrant use of a respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Appearance:	Clear
Color:	Colorless
Odor:	Irritating, Pungent, Sharp
Odor Threshold	0.3 ppm (causes olfactory fatigue)
Molecular Weight:	36.46
Molecular Formula:	HCl
Flash point:	Not flammable
Boiling Point/Range:	140 - 221 deg F (60 105 deg C)
Freezing Point/Range:	-29 to 5 deg F (-34 to -15 deg C)
Vapor Pressure:	14.6 - 80 mmHg @ 20 deg C
Vapor Density (air=1):	1.3 @ 20 deg C
Specific Gravity (water=1):	1.05 1.18
Density:	8.75 9.83 lbs/gal
Water Solubility:	100%
pH:	2 (0.2% solution)
Volatility:	9 - 36% by volume
Evaporation Rate (ether=1):	< 1.00 (butyl acetate=1)

10. STABILITY AND REACTIVITY

Reactivity/ Stability: Stable at normal temperatures and pressures.

Conditions to Avoid: Avoid heat, flames, sparks and other sources of ignition. Avoid contact with water. Will react with some metals forming flammable hydrogen gas. Hydrogen chloride may react with cyanide, forming lethal concentrations of hydrocyanic acid. Avoid contact with incompatible materials.

Incompatibilities/Materials to Avoid: Metals, Alkalis, Oxidizing agents, Mercuric sulfate, Perchloric acid, Carbides of calcium, cesium, rubidium, Acetylides of cesium and rubidium, Phosphides of calcium and uranium, Lithium Silicide

Hazardous Decomposition Products: Chlorine, Hydrogen chloride, Hydrogen gas

Hazardous Polymerization: Will not occur

11. TOXICOLOGICAL INFORMATION

Standard Draize (Eye):	rabbit-eye mild
Standard Draize (Skin):	human-skin mild

TOXICITY DATA:

Hazardous Component	LD50 Oral	LC50 Inhalation	LD50 Dermal
	700 mg/kg (Rat)	3124 ppm (1 hr-Rat)	5010 mg/kg
Hydrogen chloride	900 mg/kg (Rabbit)		(Rabbit)

TOXICITY:

Inhalation will cause severe irritation and possible burns with coughing and choking. If inhaled deeply, edema and hemorrhage of the lungs may occur. Prolonged exposure may cause discoloration and/or erosion of teeth. Contact with eyes causes immediate severe irritation with possible burns, permanent visual impairment, or total loss of sight. Skin contact with this material may cause severe irritation and corrosion of tissue. Ingestion may cause immediate burns of the mouth, esophagus, and stomach. Ingestion may cause intense pain, nausea, vomiting, bleeding, circulating collapse, shock and death.

CARCINOGENICITY: This product is not classified as a carcinogen by NTP, IARC or OSHA.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

LC50 Gambusia affinis: 282 mg/L 96 h
LC50 goldfish: 178 mg/L (1 to 2 hour survival time)
LC50 bluegill: 3.6 mg/L 48 h
LC50 shrimp: 100 330 mg/L

FATE AND TRANSPORT:

BIODEGRADATION: This material is inorganic and not subject to biodegradation.

PERSISTENCE: This material is believed not to persist in the environment. This material is believed to exist in the disassociated state in the environment. If released to soil, hydrogen chloride will sink into the soil. The acid will dissolve some soil material (in particular, anything with a carbonate base) and will be somewhat neutralized. The remaining portion is thought to transport downward to the water table. If released to water, it dissociates almost completely and will be neutralized by natural alkalinity and carbon dioxide.

BIOCONCENTRATION: This material is not expected to bioconcentrate in organisms.

ADDITIONAL ECOLOGICAL INFORMATION: This material has exhibited toxicity to terrestrial organisms. May decrease pH of waterways and adversely affect aquatic life.

13. DISPOSAL CONSIDERATIONS

Annotation:

Reuse or reprocess, if possible. Dispose in accordance with all applicable regulations. May be subject to disposal regulations: U.S. EPA 40 CFR 261.

Hazardous Waste Number(s): D002

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Hydrochloric acid solution
DOT UN NUMBER: UN1789
HAZARD CLASS/ DIVISION: 8
PACKING GROUP: II
LABELING 8
REQUIREMENTS:
DOT RQ (lbs): RQ 5,000 Lbs. (Hydrochloric acid)

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME: Hydrochloric acid solution
UN NUMBER: UN1789
CLASS: 8
PACKING/RISK GROUP: II

15. REGULATORY INFORMATION

U.S. REGULATIONS

OSHA REGULATORY STATUS:

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200) (US).

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):

If a release is reportable under CERCLA section 103, notify the state emergency response commission and local emergency planning committee. In addition, notify the National Response Center at (800) 424-8802 or (202) 4262675.

Hazardous Component	CERCLA Reportable Quantities:
Hydrogen chloride	5000 lb (final RQ)

EPCRA EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30):

If a release is reportable under EPCRA, notify the state emergency response commission and local emergency planning committee. If the TPQ is met, facilities are subject to reporting requirements under EPCRA Sections 311 and 312.

Hazardous Component	EPCRA RQs	Threshold Planning Quantity (TPQs)
Hydrogen chloride	5000 lb (EPCRA RQ)	500 lb (TPQ)

EPCRA SECTIONS 311/312 HAZARD CATEGORIES (40 CFR 370.21):

Sudden Release of Pressure, Extremely Hazardous, Acute Health Hazard

EPCRA SECTION 313 (40 CFR 372.65):

The following chemicals are listed in 40 CFR 372.65 and may be subject to Community Right-to Know Reporting requirements.

Hazardous Component	Status:
Hydrogen chloride	Listed

DEPARTMENT OF HOMELAND SECURITY (DHS)- Chemical Facility Anti-Terrorism Standards (6 CFR 27):

Hydrogen chloride is regulated under DHS as follows:

- DHS - Release Min. Concentration
- DHS - Release Screening Threshold Quantity
- DHS - Security Issue
- DHS - Theft Screening Threshold Quantity

OSHA PROCESS SAFETY (PSM) (29 CFR 1910.119):

Not regulated

NATIONAL INVENTORY STATUS

U.S. INVENTORY STATUS (TSCA): All components are listed or exempt

TSCA 12(b): This product is not subject to export notification

CANADIAN DOMESTIC SUBSTANCE LIST (DSL/NDSL): All components are listed.

STATE REGULATIONS

Hazardous Component	Hydrogen chloride	
California Proposition 65 Cancer WARNING:		Not Listed
California Proposition 65 CRT List - Male reproductive toxin:		Not Listed
California Proposition 65 CRT List - Female reproductive toxin:		Not Listed.
Massachusetts Right to Know Hazardous Substance List		Listed
New Jersey Right to Know Hazardous Substance List	sn 1012; sn 2909 (gas only)	
New Jersey Special Health Hazards Substance List	corrosive	
New Jersey - Environmental Hazardous Substance List		Listed
Pennsylvania Right to Know Hazardous Substance List		Listed
Pennsylvania Right to Know Special Hazardous Substances		Not Listed
Pennsylvania Right to Know Environmental Hazard List		Listed
Rhode Island Right to Know Hazardous Substance List		Listed

CANADIAN REGULATIONS

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

Hazardous Component	Hydrogen chloride	
Canada - CEPA Schedule I - Toxic Substance list		Not Listed
WHMIS Classification:		E

16. OTHER INFORMATION

Disclaimer:

This information is intended solely for the use of individuals trained in the NFPA and/or HMIS systems. HMIS: (SCALE 0-4) (Rated using National Paint & Coatings Association

HMIS: Rating Instructions, 2nd Edition)

Health: 3 Flammability: 0 Reactivity: 1

NFPA 704 - Hazard Identification Ratings (SCALE 0-4)

Health: 3 Flammability: 0 Reactivity: 1

Univar USA Inc Material Safety Data Sheet

For Additional Information contact MSDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process



Univar USA Inc Material Safety Data Sheet

MSDS No:

Version No:

Order No:

Univar USA Inc., 17425 NE Union Hill Rd., Redmond WA 98052
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: SULFURIC ACID 77 - 100%

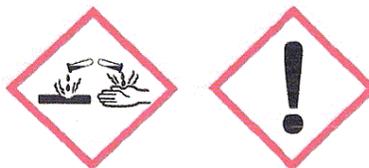
SDS DATE: 05/17/2013
REPLACES: 07/29/2011

SAFETY DATA SHEET

This Safety Data Sheet conforms to ANSI Z400.5, and to the format requirements and the International Chemical Safety Cards of the Global Harmonizing System. THIS SDS COMPLIES WITH 29 CFR 1910.1200 (HAZARD COMMUNICATION STANDARD) IMPORTANT: Read this SDS before handling & disposing of this product. Pass this information on to employees, customers, & users of this product.

SECTION 1. IDENTIFICATION OF THE SUBSTANCE OR MIXTURE AND OF THE SUPPLIER

PRODUCT IDENTITY: SULFURIC ACID 77 - 100%
SDS NUMBER: CDS1741
NEW MSDS DATE: 07/29/2011
COMPANY IDENTITY: Univar USA Inc.
COMPANY ADDRESS: 17425 NE Union Hill Road
COMPANY CITY: Redmond, WA 98052
COMPANY PHONE: 1-425-889-3400
EMERGENCY PHONES: CHEMTREC: 1-800-424-9300 (USA)
CANUTEC: 1-613-996-6666 (CANADA)



SECTION 2. HAZARDS IDENTIFICATION

DANGER!!

**EXPOSURE PREVENTION: AVOID ALL CONTACT!
PREVENT DISPERSION OF MISTS OR DUST!**

HAZARD STATEMENTS:

H100s = General, H200s = Physical, H300s = Health, H400s = Environmental

H290 May be corrosive to metals.
H300 Fatal if swallowed.
H314 Causes severe skin burns and eye damage.

PRECAUTIONARY STATEMENTS:

P100s = General, P200s = Prevention, P300s = Response, P400s = Storage, P500s = Disposal

P223 Keep away from any possible contact with water, because of violent reaction & possible flash fire.
P262 Do not get in eyes, on skin, or on clothing.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P305+351+338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present & easy to do - Continue rinsing.
P309+311 If exposed or you feel unwell: Call a POISON CENTER or doctor/physician.
P405+102 Store locked up. Keep out of reach of children.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

MATERIAL	CAS#	EINECS#	WT %
Sulfuric Acid*	7664-93-9	231-639-5	77-100
Water	7732-18-5	231-791-2	0-23

TRACE COMPONENTS: Trace ingredients (if any) are present in < 1% concentration, (< 0.1% for potential carcinogens, reproductive toxins, respiratory tract mutagens, and sensitizers). None of the trace ingredients contribute significant additional hazards at the concentrations that may be present in this product. All pertinent hazard information has been provided in this document, per the requirements of the Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalents, and Canadian Hazardous Materials Identification System Standard (CPR 4).

SEE SECTIONS 8, 11 & 12 FOR TOXICOLOGICAL INFORMATION.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: SULFURIC ACID 77 - 100%

SDS DATE: 05/17/2013
REPLACES: 07/29/2011

SECTION 4. FIRST AID MEASURES

GENERAL ADVICE:

First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists, refer to Section 8 for specific personal protective equipment.

EYE CONTACT:

If this product enters the eyes, open eyes while under gently running water. Use sufficient force to open eyelids. "Roll" eyes to expose more surface. Minimum flushing is for 15 minutes. Seek immediate medical attention.

SKIN CONTACT:

If the product contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove contaminated clothing, taking care not to contaminate eyes. If skin becomes irritated and irritation persists, medical attention may be necessary. Wash contaminated clothing before reuse, discard contaminated shoes.

INHALATION:

After high vapor exposure, remove to fresh air. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. Keep person warm and at rest. breathing is difficult, give oxygen. If breathing has stopped, trained personnel should immediately begin artificial respiration. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. If the heart has stopped, trained personnel should immediately begin cardiopulmonary resuscitation (CPR). Seek immediate medical attention. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

SWALLOWING:

If swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, give two glasses of water to drink. DO NOT INDUCE VOMITING. Never induce vomiting or give liquids to someone who is unconscious, having convulsions, or unable to swallow. Seek immediate medical attention.

NOTES TO PHYSICIAN:

There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Any material aspirated during vomiting may cause lung injury. Therefore, emesis should not be induced mechanically or pharmacologically. If it is considered necessary to evacuate the stomach contents, this should be done by means least likely to cause aspiration (such as: Gastric lavage after endotracheal intubation).

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take a copy of label and SDS to physician or health professional with victim.

SECTION 5. FIRE FIGHTING MEASURES

FIRE & EXPLOSION PREVENTIVE MEASURES

Not Applicable.

EXTINGUISHING MEDIA

Expect violent reaction with water. For small fires use dry chemical, carbon dioxide or halon. For large fires, flood fire area with water from a distance. Do not get solid stream of water on spilled material.

SPECIAL FIRE FIGHTING PROCEDURES

Water spray may be ineffective on fire but can protect fire-fighters & cool closed containers. Use fog nozzles if water is used. Do not enter confined fire-space without full bunker gear. (Helmet with face shield, bunker coats, gloves & rubber boots). Use NIOSH approved positive-pressure self-contained breathing apparatus.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: SULFURIC ACID 77 - 100%

SDS DATE: 05/17/2013
REPLACES: 07/29/2011

SECTION 5. FIRE FIGHTING MEASURES (CONTINUED)

UNUSUAL EXPLOSION AND FIRE PROCEDURES

Noncombustible.

Reacts with most metals producing hydrogen which is extremely flammable & may explode. Applying to hot surfaces requires special precautions. Closed containers may explode if exposed to extreme heat.

SECTION 6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE AND ENVIRONMENTAL PRECAUTIONS:

Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area, protect people, and respond with trained personnel.

PERSONAL PROTECTIVE EQUIPMENT

The proper personal protective equipment for incidental releases (such as: 1 Liter of the product released in a well-ventilated area), use impermeable gloves (triple-gloves (rubber gloves and nitrile gloves, over latex gloves), goggles, face shield, and appropriate body protection. In the event of a large release, use impermeable gloves, specific for the material handled, chemically resistant suit and boots, and hard hat. Self-Contained Breathing Apparatus or respirator may be required where engineering controls are not adequate or conditions for potential exposure exist. When respirators are required, select NIOSH/MSHA approved based on actual or potential airborne concentrations in accordance with latest OSHA and/or ANSI recommendations.

ENVIRONMENTAL PRECAUTIONS:

Stop spill at source. Construct temporary dikes of dirt, sand, or any appropriate readily available material to prevent spreading of the material. Close or cap valves and/or block or plug hole in leaking container and transfer to another container. Keep from entering storm sewers and ditches which lead to waterways, and if necessary, call the local fire or police department for immediate emergency assistance.

CONTAINMENT AND CLEAN-UP MEASURES:

Absorb spilled liquid with polypads or other suitable absorbent materials. If necessary, neutralize using suitable buffering material, (acid with soda ash or base with phosphoric acid), and test area with litmus paper to confirm neutralization. Clean up with non-combustible absorbent (such as: sand, soil, and so on). Shovel up and place all spill residue in suitable containers. dispose of at an appropriate waste disposal facility according to current applicable laws and regulations and product characteristics at time of disposal (see Section 13 - Disposal Considerations).

SECTION 7. HANDLING AND STORAGE

HANDLING

Use only with adequate ventilation. Do not get in eyes, on skin or clothing. Wear OSHA Standard full face shield. Consult Safety Equipment Supplier. Wear gloves, apron & footwear impervious to this material. Wash clothing before reuse. NEVER pour water into this substance. When dissolving or diluting, always add it slowly to the water. To minimize static discharge when transferring, ensure electrical continuity by bonding and grounding all equipment. Use an inlet line diameter of at least 3.5 inches (8.9 centimeters) with a maximum flow rate of 1 meter/second.

STORAGE

Keep separated from strong oxidants, strong bases, combustible & reducing substances, metals, food & feedstuffs, incompatible materials. May be stored in stainless steel containers. See: Section 10, <Materials to Avoid>. Do not store above 49 C/120 F. Keep container tightly closed & upright when not in use to prevent leakage. Reacts with most metals producing hydrogen which is extremely flammable & may explode. Wear full face shield, gloves & full protective clothing when opening or handling. When empty, drain completely, replace bungs securely.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: SULFURIC ACID 77 - 100%

SDS DATE: 05/17/2013
REPLACES: 07/29/2011

SECTION 7. HANDLING AND STORAGE (CONTINUED)

BULK CONTAINERS:

All tanks and pipelines which contain this material must be labeled. Perform routine maintenance on tanks or pipelines which contain this product. Report all leaks immediately to the proper personnel.

TANK CAR SHIPMENTS:

Tank cars carrying this product should be loaded and unloaded in strict accordance with tank-car manufacturer's recommendation and all established on-site safety procedures. Appropriate personal protective equipment must be used (see Section 8, Engineering Controls and Personal Protective Equipment.). All loading and unloading equipment must be inspected, prior to each use. Loading and unloading operations must be attended, at all times. Tank cars must be level, brakes must be set or wheels must be locked or blocked prior to loading or unloading. Tank car (for loading) or storage tanks (for unloading) must be verified to be correct for receiving this product and be properly prepared, prior to starting the transfer operations. Hoses must be verified to be in the correct positions, before starting transfer operations. A sample (if required) must be taken and verified (if required) prior to starting transfer operations. All lines must be blown-down and purged before disconnecting them from the tank car or vessel.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:

Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

MATERIAL	CAS#	EINECS#	TWA (OSHA)	TLV (ACGIH)
Sulfuric Acid*	7664-93-9	231-639-5	None Known	None Known
Water	7732-18-5	231-791-2	None Known	None Known

This product contains no EPA Hazardous Air Pollutants (HAP) in amounts > 0.1%.

RESPIRATORY EXPOSURE CONTROLS

Maintain airborne contaminant concentrations below exposure limits given above. If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134, European Standard EN 149, or applicable State regulations. If adequate ventilation is not available or there is potential for airborne exposure above the exposure limits, a respirator may be worn up to the respirator exposure limitations, check with respirator equipment manufacturer's recommendations/limitations. For a higher level of protection, use positive pressure supplied air respiration protection or Self Contained Breathing Apparatus or if oxygen levels are below 19.5% or are unknown.

EMERGENCY OR PLANNED ENTRY INTO UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS

Positive pressure, full-face piece Self Contained Breathing Apparatus; or positive pressure, full-face piece Self Contained Breathing Apparatus with an auxilliary positive pressure Self Contained Breathing Apparatus.

VENTILATION

LOCAL EXHAUST: Necessary MECHANICAL (GENERAL): Necessary
SPECIAL: None OTHER: None
Please refer to ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

EYE PROTECTION:

Splash goggles or safety glasses. Face-shields are recommended when the operation can generate splashes, sprays or mists.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: SULFURIC ACID 77 - 100%

SDS DATE: 05/17/2013
REPLACES: 07/29/2011

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION (CONTINUED)

HAND PROTECTION:

Wear appropriate impervious gloves for routine industrial use. Use impervious gloves for spill response, as stated in Section 6 of this SDS (Accidental Release Measures).

NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

BODY PROTECTION:

Use body protection appropriate for task. Cover-all, rubber aprons, or chemical protective clothing made from impervious materials are generally acceptable, depending on the task.

WORK & HYGIENIC PRACTICES:

Provide readily accessible eye wash stations & safety showers. Wash after each workshift & before eating, smoking or using the toilet. Promptly remove contaminated clothing. Destroy contaminated leather articles. Launder or discard contaminated clothing.

SECTION 9. PHYSICAL & CHEMICAL PROPERTIES

APPEARANCE:	Oily Liquid, Water-White
ODOR:	None
ODOR THRESHOLD:	Not Available
pH (Neutrality):	0.0
MELTING POINT/FREEZING POINT:	-11 to -29 C / +12 to -20 F
BOILING RANGE (IBP,50%,Dry Point):	193 to 276 C / 380 to 529 F
FLASH POINT (TEST METHOD):	Not Applicable
EVAPORATION RATE (n-BUTYL ACETATE=1):	Not Applicable
FLAMMABILITY CLASSIFICATION:	Non-Combustible
LOWER FLAMMABLE LIMIT IN AIR (% by vol):	Not Applicable
UPPER FLAMMABLE LIMIT IN AIR (% by vol):	Not Available
VAPOR PRESSURE (mm of Hg)@20 C	17.5
VAPOR DENSITY (air=1):	Not Applicable
GRAVITY @ 68/68F / 20/20C:	
SPECIFIC GRAVITY (Water=1):	1.70 to 1.84
POUNDS/GALLON:	14.2 to 15.3
WATER SOLUBILITY:	Complete
PARTITION COEFFICIENT (n-Octane/Water):	Not Available
AUTO IGNITION TEMPERATURE:	Not Applicable
DECOMPOSITION TEMPERATURE:	Not Available

SECTION 10. STABILITY & REACTIVITY

STABILITY

Stable but Reacts with most metals producing hydrogen which is extremely flammable & may explode.

CONDITIONS TO AVOID

Avoid alkalis. When diluting, always add acid to diluent. DON'T add diluent to acid.

MATERIALS TO AVOID

The substance is a strong acid, reacts violently with bases and is corrosive. Upon heating, irritating and toxic fumes are formed including sulfur oxides, The substance is a strong oxidant & reacts violently with combustible & reducing materials. Corrosive to most common metals forming flammable/explosive gas (hydrogen). Sulfuric acid reacts violently with water & organic materials with much heat. Isolate from organics, chlorates, carbides, fulminates, picrates, metals. Fire risk on contact with organic materials and chemicals such as nitrates, carbides, and chlorates.

HAZARDOUS DECOMPOSITION PRODUCTS

Sulfur Oxides.

HAZARDOUS POLYMERIZATION

Will not occur.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: SULFURIC ACID 77 - 100%

SDS DATE: 05/17/2013
REPLACES: 07/29/2011

SECTION 11. TOXICOLOGICAL INFORMATION

ACUTE HAZARDS

EYE & SKIN CONTACT:

Severe burns to skin, defatting, dermatitis.
Severe burns to eyes, redness, tearing, blurred vision.
Liquid can cause severe skin & eye burns. Wash thoroughly after handling.

INHALATION:

Severe respiratory tract irritation may occur. Vapor harmful.

SWALLOWING:

Harmful or fatal if swallowed.

SUBCHRONIC HAZARDS/CONDITIONS AGGRAVATED

CONDITIONS AGGRAVATED:

Persons with skin conditions should avoid use.

CHRONIC HAZARDS

CANCER, REPRODUCTIVE & OTHER CHRONIC HAZARDS:

Sulfuric Acid in the form of strong inorganic acid mists is known to cause cancer.

IRRITANCY OF PRODUCT: This product is irritating to contaminated tissue.

SENSITIZATION TO THE PRODUCT: No component of this product is known to be a sensitizer.

MUTAGENICITY: This product is not reported to produce mutagenic effects in humans.

EMBRYOTOXICITY: This product is not reported to produce embryotoxic effects in humans.

TERATOGENICITY: This product is not reported to produce teratogenic effects in humans.

REPRODUCTIVE TOXICITY: This product is not reported to cause reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (such as: within the eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MAMMALIAN TOXICITY INFORMATION

Oral LD50 (Rats):	2140 mg/kg
Dermal LD50 (Rabbit):	Not Available
LC50 (Inhalation, Rats):	510 mg/m3 (4 hour exposure)
Skin effects (Rabbit):	Severe irritation
Eye effects (Rabbit):	Severe irritation

LD (adult human): between 5 ml and 15 ml (concentrated sulfuric acid)

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: SULFURIC ACID 77 - 100%

SDS DATE: 05/17/2013
REPLACES: 07/29/2011

SECTION 12. ECOLOGICAL INFORMATION

AQUATIC ANIMAL INFORMATION:

No aquatic environmental information is available on this product.
The substance is harmful to aquatic organisms.

MOBILITY IN SOIL

Mobility of this material has not been determined.

DEGRADABILITY

This product is completely biodegradable.

ACCUMULATION

Bioaccumulation of this product has not been determined.

SECTION 13. DISPOSAL CONSIDERATIONS

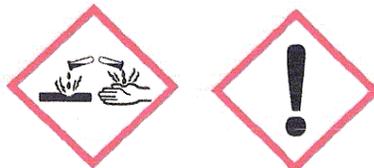
Processing, use or contamination may change the waste disposal requirements. Do not dispose of on land, in surface waters, or in storm drains. Waste should be recycled or disposed of in accordance with regulations. Large amounts should be collected for reuse or consigned to licensed hazardous waste haulers for disposal.

ALL DISPOSAL MUST BE IN ACCORDANCE WITH ALL FEDERAL, STATE, PROVINCIAL, AND LOCAL REGULATIONS. IF IN DOUBT, CONTACT PROPER AGENCIES. EPA CHARACTERISTIC: D002.

SECTION 14. TRANSPORT INFORMATION

> 1099 LB / 499 KG OF THIS PRODUCT IN 1 CONTAINER EXCEEDS THE "RQ" OF SULFURIC ACID.

DOT SHIPPING NAME: UN1830, Sulfuric acid, 8, PG-II
DRUM LABEL: (CORROSIVE)
IATA / ICAO: UN1830, Sulfuric acid, 8, PG-II
IMO / IMDG: UN1830, Sulfuric acid, 8, PG-II
EMERGENCY RESPONSE GUIDEBOOK NUMBER: 137



SECTION 15. REGULATORY INFORMATION

EPA REGULATION:

SARA SECTION 311/312 HAZARDS: Acute Health

All components of this product are on the TSCA list.

SARA Title III Section 313 Supplier Notification

This product contains the indicated <*> toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning & Community Right-To-Know Act of 1986 & of 40 CFR 372. This information must be included in all MSDSs that are copied and distributed for this material.

SARA TITLE III INGREDIENTS	CAS#	EINECS#	WT%	(REG.SECTION)	RQ(LBS)
Sulfuric Acid	7664-93-9	231-639-5	77-100	(302,311,312,313)	1000

Any release equal to or exceeding the RQ must be reported to the National Response Center (800-424-8802) and appropriate state and local regulatory agencies as described in 40 CFR 302.6 and 40 CFR 355.40 respectively. Failure to report may result in substantial civil and criminal penalties. State & local regulations may be more restrictive than federal regulations.

COMPANY IDENTITY: Univar USA Inc.
PRODUCT IDENTITY: SULFURIC ACID 77 - 100%

SDS DATE: 05/17/2013
REPLACES: 07/29/2011

SECTION 15. REGULATORY INFORMATION (CONTINUED)

SARA Title III Section 302 (Extremely Hazardous Substance List) : Sulfuric Acid.

CLEAN WATER ACT:

Sulfuric Acid is listed as a Hazardous Substance under the Clean Water Act.

STATE REGULATIONS:

CALIFORNIA PROPOSITION 65: WARNING: This product contains Sulfuric Acid, listed as "Strong inorganic acid mists contain", a chemical known to the state of California to cause cancer.

INTERNATIONAL REGULATIONS

The components of this product are listed on the chemical inventories of the following countries:

Australia (AICS), Canada (DSL, NDSL), China (IECSC), Europe (EINECS, ELINCS), Japan (METI/CSCL, MHLW/ISHL), South Korea (KECI), New Zealand (NZIoC), Philippines (PICCS), Switzerland (SWISS), Taiwan (NECSI), USA (TSCA).

CANADA: WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)

D1A: Material causing immediate and serious toxic effects (VERY TOXIC), (Sulfuric Acid)

D2B: Irritating to skin / eyes.

E: Corrosive Material.

SECTION 16. OTHER INFORMATION

HAZARD RATINGS:

HEALTH (NFPA): 3, HEALTH (HMIS): 3, FLAMMABILITY: 0, REACTIVITY: 2
(Personal Protection Rating to be supplied by user based on use conditions.)
This information is intended solely for the use of individuals trained in the NFPA & HMIS hazard rating systems.

EMPLOYEE TRAINING

See Section 2 for Risk & Safety Statements. Employees should be made aware of all hazards of this material (as stated in this SDS) before handling it.

Univar USA Inc Material Safety Data Sheet

For Additional Information contact MSDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process



**Univar USA Inc.
6100 Carillon Point
Kirkland, WA 98033
(425) 889-3400**

For Emergency Assistance involving chemicals call - CHEMTREC (800) 424-9300

The Version Date for this MSDS is : 09/13/2005

PRODUCT NAME: FERROUS SULFATE ALL GRADES - IRON SULFATE (COPPERAS)

MSDS NUMBER: MZF1804

DATE ISSUED: 9/12/2005

SUPERSEDES: 8/23/2004

ISSUED BY: 008614

FERROUS SULFATE

1. PRODUCT IDENTIFICATION

Distributed by:

Univar USA Inc.
6100 Carillon Point
Kirkland, WA 98003-7357
425-889-5000

SYNONYMS: FERROUS SULPHATE; IRON SULFATE; SULFURIC ACID, IRON (2+)
SALT (1:1),

CAS NO: 7720-78-7 (Anhydrous)

7782-63-0 (Heptahydrate)

17375-41-6 (Monohydrate)

MOLECULAR WEIGHT: NOT APPLICABLE TO MIXTURES.

CHEMICAL FORMULA: $\text{FeSO}_4 \cdot \text{XH}_2\text{O}$

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT CAS NO PERCENT HAZARDOUS

FERROUS SULFATE ANHYDROUS 7720-78-7 100% YES
FERROUS SULFATE HEPTAHYDRATE 7782-63-0 100% YES
FERROUS SULFATE MONOHYDRATE 17375-41-6 100% YES

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE LIVER.

POTENTIAL HEALTH EFFECTS

INHALATION:

CAUSES IRRITATION TO THE RESPIRATORY TRACT. SYMPTOMS MAY INCLUDE COUGHING, SHORTNESS OF BREATH.

INGESTION:

LOW TOXICITY IN SMALL QUANTITIES BUT LARGER DOSAGES MAY CAUSE NAUSEA, VOMITING, DIARRHEA, AND BLACK STOOL. PINK URINE DISCOLORATION IS A STRONG INDICATOR OF IRON POISONING. LIVER DAMAGE, COMA, AND DEATH FROM IRON POISONING HAS BEEN RECORDED. SMALLER DOSES ARE MUCH MORE TOXIC TO CHILDREN.

SKIN CONTACT:

CAUSES IRRITATION TO SKIN. SYMPTOMS INCLUDE REDNESS, ITCHING, AND PAIN.

EYE CONTACT:

CAUSES IRRITATION, REDNESS, AND PAIN.

CHRONIC EXPOSURE:

SEVERE OR CHRONIC FERROUS SULFATE POISONINGS MAY DAMAGE BLOOD VESSELS. LARGE CHRONIC DOSES CAUSE RICKETS IN INFANTS. CHRONIC EXPOSURE MAY CAUSE LIVER EFFECTS. PROLONGED EXPOSURE OF THE EYES MAY CAUSE DISCOLORATION.

AGGRAVATION OF PRE-EXISTING CONDITIONS:

PERSONS WITH PRE-EXISTING SKIN DISORDERS OR EYE PROBLEMS, OR IMPAIRED LIVER, KIDNEY OR RESPIRATORY FUNCTION MAY BE MORE SUSCEPTIBLE TO THE EFFECTS OF THE SUBSTANCE.

4. FIRST AID MEASURES

INHALATION:

REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. GET MEDICAL ATTENTION.

INGESTION:

INDUCE VOMITING IMMEDIATELY AS DIRECTED BY MEDICAL PERSONNEL. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. GET MEDICAL ATTENTION.

SKIN CONTACT:

IMMEDIATELY FLUSH SKIN WITH PLENTY OF SOAP AND WATER FOR AT LEAST 15 MINUTES. REMOVE CONTAMINATED CLOTHING AND SHOES. GET MEDICAL ATTENTION. WASH CLOTHING BEFORE REUSE. THOROUGHLY CLEAN SHOES BEFORE REUSE.

EYE CONTACT:

IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES, LIFTING LOWER AND UPPER EYELIDS OCCASIONALLY. GET MEDICAL ATTENTION IMMEDIATELY.

5. FIRE FIGHTING MEASURES

FIRE:

NOT CONSIDERED TO BE A FIRE HAZARD.

EXPLOSION:

NOT CONSIDERED TO BE AN EXPLOSION HAZARD.

FIRE EXTINGUISHING MEDIA:

USE ANY MEANS SUITABLE FOR EXTINGUISHING SURROUNDING FIRE.

SPECIAL INFORMATION:

USE PROTECTIVE CLOTHING AND BREATHING EQUIPMENT APPROPRIATE FOR THE SURROUNDING FIRE.

6. ACCIDENTAL RELEASE MEASURES

VENTILATE AREA OF LEAK OR SPILL. WEAR APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AS SPECIFIED IN SECTION 8. SPILLS: PICK UP AND PLACE IN A SUITABLE CONTAINER FOR RECLAMATION OR DISPOSAL, USING A METHOD THAT DOES NOT GENERATE DUST. US REGULATIONS (CERCLA) REQUIRE REPORTING SPILLS AND RELEASES TO SOIL, WATER AND AIR IN EXCESS OF REPORTABLE QUANTITIES. THE TOLL FREE NUMBER FOR THE US COAST GUARD NATIONAL RESPONSE CENTER IS (800) 424-8802.

7. HANDLING AND STORAGE

KEEP IN A WELL CLOSED CONTAINER STORED UNDER COLD TO WARM CONDITIONS, 2 TO 40 C, (36 TO 104F). PROTECT AGAINST PHYSICAL DAMAGE. ISOLATE FROM INCOMPATIBLE SUBSTANCES. CONTAINERS OF THIS MATERIAL MAY BE HAZARDOUS WHEN EMPTY SINCE THEY RETAIN PRODUCT RESIDUES (DUST, SOLIDS); OBSERVE ALL

WARNINGS AND PRECAUTIONS LISTED FOR THE PRODUCT.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

AIRBORNE EXPOSURE LIMITS:

-ACGIH THRESHOLD LIMIT VALUE (TLV):
1 MG/M³ (TWA) SOLUBLE IRON SALT AS FE

VENTILATION SYSTEM:

A SYSTEM OF LOCAL AND/OR GENERAL EXHAUST IS RECOMMENDED TO KEEP EMPLOYEE EXPOSURES BELOW THE AIRBORNE EXPOSURE LIMITS. LOCAL EXHAUST VENTILATION IS GENERALLY PREFERRED BECAUSE IT CAN CONTROL THE EMISSIONS OF THE CONTAMINANT AT ITS SOURCE, PREVENTING DISPERSION OF IT INTO THE GENERAL WORK AREA. PLEASE REFER TO THE ACGIH DOCUMENT, "INDUSTRIAL VENTILATION, A MANUAL OF RECOMMENDED PRACTICES", MOST RECENT EDITION, FOR DETAILS.

PERSONAL RESPIRATORS (NIOSH APPROVED):

IF THE EXPOSURE LIMIT IS EXCEEDED, A HALF-FACE DUST/MIST RESPIRATOR MAY BE WORN FOR UP TO TEN TIMES THE EXPOSURE LIMIT OR THE MAXIMUM USE CONCENTRATION SPECIFIED BY THE APPROPRIATE REGULATORY AGENCY OR RESPIRATOR SUPPLIER, WHICHEVER IS LOWEST. A FULL-FACE PIECE DUST/MIST RESPIRATOR MAY BE WORN UP TO 50 TIMES THE EXPOSURE LIMIT, OR THE MAXIMUM USE CONCENTRATION SPECIFIED BY THE APPROPRIATE REGULATORY AGENCY, OR RESPIRATOR SUPPLIER, WHICHEVER IS LOWEST. FOR EMERGENCIES OR INSTANCES WHERE THE EXPOSURE LEVELS ARE NOT KNOWN, USE A FULL-FACEPIECE POSITIVE-PRESSURE, AIR-SUPPLIED RESPIRATOR. WARNING: AIR-PURIFYING RESPIRATORS DO NOT PROTECT WORKERS IN OXYGEN-DEFICIENT ATMOSPHERES.

SKIN PROTECTION:

WEAR IMPERVIOUS PROTECTIVE CLOTHING, INCLUDING BOOTS, GLOVES, LAB COAT, APRON OR COVERALLS, AS APPROPRIATE, TO PREVENT SKIN CONTACT.

EYE PROTECTION:

USE CHEMICAL SAFETY GOGGLES AND/OR FULL FACE SHIELD WHERE DUSTING OR SPLASHING OF SOLUTIONS IS POSSIBLE. MAINTAIN EYE WASH FOUNTAIN AND QUICK-DRENCH FACILITIES IN WORK AREA.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: BOILING POINT:

WHITE TO SLIGHTLY YELLOW TINGED NOT APPLICABLE.
POWDER.

ODOR: MELTING POINT:

ODORLESS. 500C (932F)

SOLUBILITY: VAPOR DENSITY (AIR=1):
SOLUBLE IN WATER. NO INFORMATION FOUND.

DENSITY: VAPOR PRESSURE (MM HG):
NO INFORMATION FOUND. NO INFORMATION FOUND.

PH: EVAPORATION RATE (BUAC=1):
NO INFORMATION FOUND. NO INFORMATION FOUND.

% VOLATILES BY VOLUME @ 21C (70F):
0

10. STABILITY AND REACTIVITY

STABILITY:
STABLE UNDER ORDINARY CONDITIONS OF USE AND STORAGE.

HAZARDOUS DECOMPOSITION PRODUCTS:
BURNING MAY PRODUCE SULFUR OXIDES.

HAZARDOUS POLYMERIZATION:
WILL NOT OCCUR.

INCOMPATIBILITIES:
ALKALIS, SOLUBLE CARBONATES, AND OXIDIZING MATERIALS. REACTS IN MOIST AIR
TO FORM FERRIC SULFATE.

CONDITIONS TO AVOID:
MOISTURE.

11. TOXICOLOGICAL INFORMATION

FERROUS SULFATE HEPTAHYDRATE: ORAL MOUSE LD50: 1520 MG/KG, INVESTIGATED AS
A MUTAGEN. FERROUS SULFATE ANHYDROUS: ORAL RAT LD50: 319 MG/KG;
INVESTIGATED AS A MUTAGEN, TUMORIGEN, REPRODUCTIVE EFFECTOR.

-----/CANCER LISTS/-----
---NTP CARCINOGEN---
INGREDIENT KNOWN ANTICIPATED IARC CATEGORY

FERROUS SULFATE NO NO NONE

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE:
NO INFORMATION FOUND.

ENVIRONMENTAL TOXICITY:
NO INFORMATION FOUND.

13. DISPOSAL CONSIDERATIONS

WHATEVER CANNOT BE SAVED FOR RECOVERY OR RECYCLING SHOULD BE MANAGED IN AN APPROPRIATE AND APPROVED WASTE DISPOSAL FACILITY. PROCESSING, USE OR CONTAMINATION OF THIS PRODUCT MAY CHANGE THE WASTE MANAGEMENT OPTIONS. STATE AND LOCAL DISPOSAL REGULATIONS MAY DIFFER FROM FEDERAL DISPOSAL REGULATIONS.

DISPOSE OF CONTAINER AND UNUSED CONTENTS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REQUIREMENTS.

14. TRANSPORT INFORMATION

NOT REGULATED.

15. REGULATORY INFORMATION

-----/CHEMICAL INVENTORY STATUS - PART 1/-----
INGREDIENT TSCA EC JAPAN AUSTRALIA

FERROUS SULFATE (7720-78-7) YES YES YES YES

-----/CHEMICAL INVENTORY STATUS - PART 2/-----

--CANADA--

INGREDIENT KOREA DSL NDSL PHIL.

FERROUS SULFATE (7720-78-7) YES YES NO YES

-----/FEDERAL, STATE & INTERNATIONAL REGULATIONS - PART 1/-----

-SARA 302- -----SARA 313-----

INGREDIENT RQ TPQ LIST CHEMICAL CATG

FERROUS SULFATE (7720-78-7) NO NO NO NO

-----/FEDERAL, STATE & INTERNATIONAL REGULATIONS - PART 2/-----

-RCRA- -TSCA-

INGREDIENT CERCLA 261.33 8(D)

FERROUS SULFATE (7720-78-7) 1000 NO NO

CHEMICAL WEAPONS CONVENTION: NO TSCA 12(B): NO CDTA: NO
SARA 311/312: ACUTE: YES CHRONIC: YES FIRE: NO PRESSURE: NO
REACTIVITY: NO (MIXTURE / SOLID)

AUSTRALIAN HAZCHEM CODE: NONE ALLOCATED.
POISON SCHEDULE: NONE ALLOCATED.

WHMIS: THIS MSDS HAS BEEN PREPARED ACCORDING TO THE HAZARD CRITERIA OF
THE CONTROLLED PRODUCTS REGULATIONS (CPR) AND THE MSDS CONTAINS
ALL OF THE INFORMATION REQUIRED BY THE CPR.

16. OTHER INFORMATION

NFPA RATINGS:

HEALTH: 1 FLAMMABILITY: 0 REACTIVITY: 0

For Additional Information:

Contact: MSDS Coordinator - Univar USA

During business hours, Pacific Time - (425) 889-3400

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